AVIATION WEEK

A McGRAW-HILL PUBLICATION

July 9, 1956 50 Cents

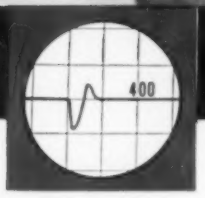
Corporal Gives Army Nuclear Artillery

Grumman F9F-8 Cougar

Special Report From Moscow on Aeroflot

First in Constant Speed Drives...

SUNDSTRAND



Sundstrand Constant Speed Drives bring new concept to naval warfare!

Bright star of Navy's new concept in naval warfare—the Seaplane Striking Force—is the Martin XP6M SeaMaster. This new craft, which cruises at 40,000 ft. and is in the 600 mph class, is equipped with constant frequency a-c power, the new concept in aircraft electrical systems. Fostered by the Sundstrand Constant Speed Drive, this new electrical system provides plenty of stable electrical power from paralleled alternators, with close frequency and voltage control. Motors, electronic devices, and other frequency and voltage-sensitive equipment operate at optimum level. This is another example of how the new concept in electrical systems . . . fostered by Sundstrand's Constant Speed Drive . . . meets the challenge of today's . . . and tomorrow's . . . fast, high-flying jet aircraft.

New Electrical Horizons . . .

are opening to design engineers, through co-operation between engine and airframe manufacturers and Sundstrand. With this advanced design in electrical systems, expect remarkable advances in operation and performance of tomorrow's aircraft.

SUNDSTRAND AVIATION

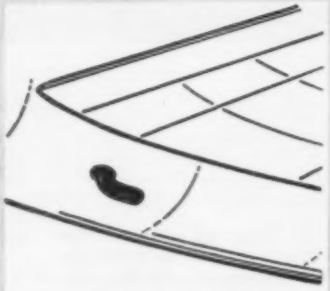
Division of Sundstrand Machine Tool Company, ROCKFORD, ILLINOIS Western District Office: Hawthorne, California

CONSTANT SPEED DRIVES · AIRCRAFT ACCESSORIES

The end of the Ice Age

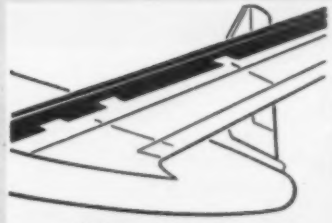
ICE—and its attendant hazards—have, since the beginning of flight, impeded the progress of all-weather flight. Now, when our very survival may depend upon aircraft aloft in *any* weather, comes the modern solution to this age-old problem—the Iceguard by Goodyear.

Here is *fully proved*, foolproof ice protection for aircraft—for propellers, wings, empennage—for air scoops, antennas, pipe and conduit—for any surface—any size, any shape.



YOUR PROBLEM SMALL?

Here, for relief tubes, is an Iceguard 2⅝ inches small—made of *electrically conductive rubber.*



YOUR PROBLEM BIG?

Here, for a wing leading edge, is an Iceguard—made of resistance wire and divider strip heaters molded into a special erosion-resistant rubber. Iceguard applications of this type *have been built* by Goodyear *up to 17 feet in length.*

YOUR PROBLEM SHAPE?

Here, specially designed for air scoops, is an Iceguard—made of electrically conductive rubber.

No matter what the size, no matter how complex the contour, no matter how tough the problem—here is fully automatic, electrothermal ice protection with the Iceguard by Goodyear—long a pioneer in aviation.

For details write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California

ICEGUARD

Pioneer Ice Protection by

GOODYEAR AVIATION PRODUCTS

"Ninety for dinner, Virginia"

It's a breeze for Virginia and Elé. Their new, compact Weber buffet is so convenient, so efficient. It's so easy to provide tempting meals for eighty-five passengers and the crew of American Airlines' "The Royal Coachman," first non-stop DC-7 aircoach service coast to coast.

At 365 miles an hour, the Douglas DC-7 wings across the country, miles above the ground. Virginia and Elé serve superbly prepared food, to delight the most jaded palate and refresh the weariest traveler. Throughout the flight, hot and cold beverages are available from the Weber-designed buffet. American Airlines, Douglas and Weber have combined forces for another "first" in air travel.

The meticulous engineering and tasteful styling of Weber buffets make them the choice of aircraft manufacturers and airlines alike.

From any point of view, Weber is the choice in aircraft interior equipment.

WEBER AIRCRAFT CORPORATION
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AVIATION CALENDAR

July 15-30—World Parachuting Championship, Moscow, Russia.

July 17-19—Air Transport Association Agency Committee Meeting, Sheraton-Park Hotel, Washington, D. C.

July 31-Aug. 9—23rd Annual U. S. National Soaring Competitions, Aug. 5—Air Show, Grand Prairie Airport, Grand Prairie, Texas.

Aug. 1-5—Air Force Association's 1956 National Convention and Airpower Panorama, Roosevelt Hotel, New Orleans, La.

Aug. 6-8—Society of Automotive Engineers National West Coast Meeting, Mark Hopkins Hotel, San Francisco, Calif.

Aug. 7-9—Air Transport Association Standard Practices Committee Meeting, Palace Hotel, San Francisco, Calif.

Aug. 15-17—Institute of the Aeronautical Sciences, National Turbine-Powered Air Transportation Meeting, Grand Hotel, San Diego, Calif.

Aug. 21-24—Western Electronic Show and Convention, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Aug. 22-24—Bendix Aviation Corp.'s 1956 International Ignition Conference, Sidney, New York.

Aug. 27-29—Association for Computing Machinery, University of California Westwood Campus, Los Angeles.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 16-22—American Society for Testing Materials, Second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles.

Sept. 17—International Air Transport Association, 12th annual general meeting, Edinburgh, Scotland.

Sept. 17-21—Eleventh Annual Instrument-Automation Conference & Exhibit, sponsored by the Instrument Society of America, Coliseum, New York, N. Y.

Sept. 17-22—International Congress of Astronautics, sponsored by the International Astronautic Federation, Rome, Italy.

Sept. 23-26—American Society of Mechanical Engineers, Petroleum Conference, Hotel Statler, Dallas, Tex.

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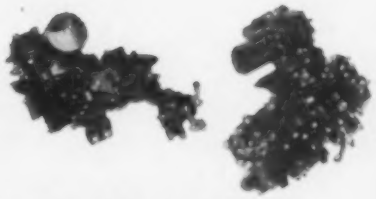
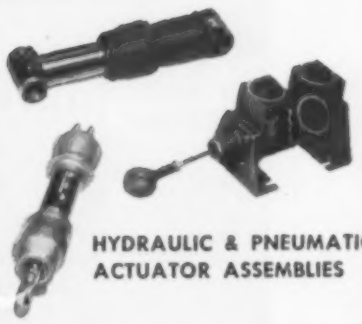
Ex-Cell-O Precision at Production Prices

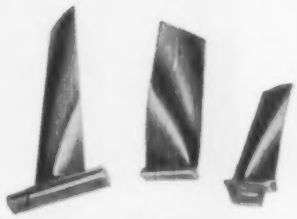


FUEL CONTROL AND METERING ASSEMBLIES



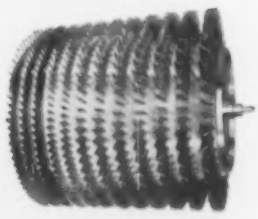
HYDRAULIC & PNEUMATIC ACTUATOR ASSEMBLIES

FUEL NOZZLES FOR JET ENGINES



JET ENGINE BLADES

MISCELLANEOUS AIRCRAFT AND COMMERCIAL PRECISION PARTS



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Ex-Cell-O's facilities include laboratory control of materials, design and process engineering, machining of all materials, complete quality control to meet the most rigid specifications, and delivery to meet customers' requirements.

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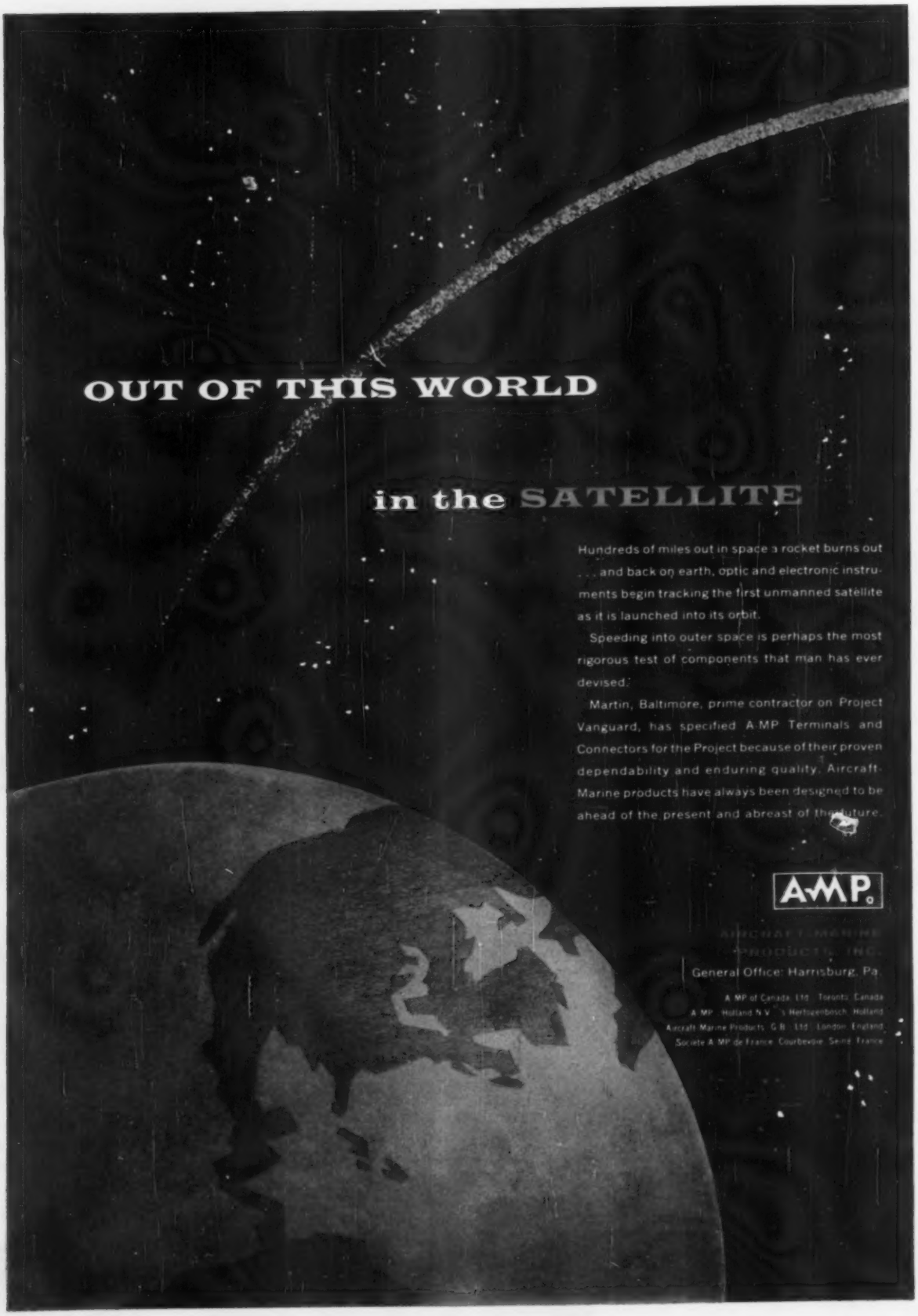
OUT OF THIS WORLD
in the SATELLITE
Hundreds of miles out in space a rocket burns out . . . and back on earth, optic and electronic instruments begin tracking the first unmanned satellite as it is launched into its orbit.
Speeding into outer space is perhaps the most rigorous test of components that man has ever devised.
Martin, Baltimore, prime contractor on Project Vanguard, has specified A-MP Terminals and Connectors for the Project because of their proven dependability and enduring quality. Aircraft-Marine products have always been designed to be ahead of the present and abreast of the future.
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features *"hush-flight"*

engine suspension by **LORD**

The "hush-flight" of the Cessna 182 features exceptional quiet, flight smoothness, safety, and comfort, with engine and propeller noise and vibration greatly reduced through LORD Dynafocal® mountings. This flexible engine suspension system supports all engine weight and minimizes airframe vibration and fatigue.

The LORD Dynafocal application in this executive craft is another example of LORD's ability to solve vibration problems for the aircraft industry. For information, call your nearest LORD Field Engineer or the Home Office, Erie, Pennsylvania.

Cessna's complete air fleet is equipped with Lord mountings:

Mounting arrangement at each point of Lord Dynafocal Suspension on Cessna 182.

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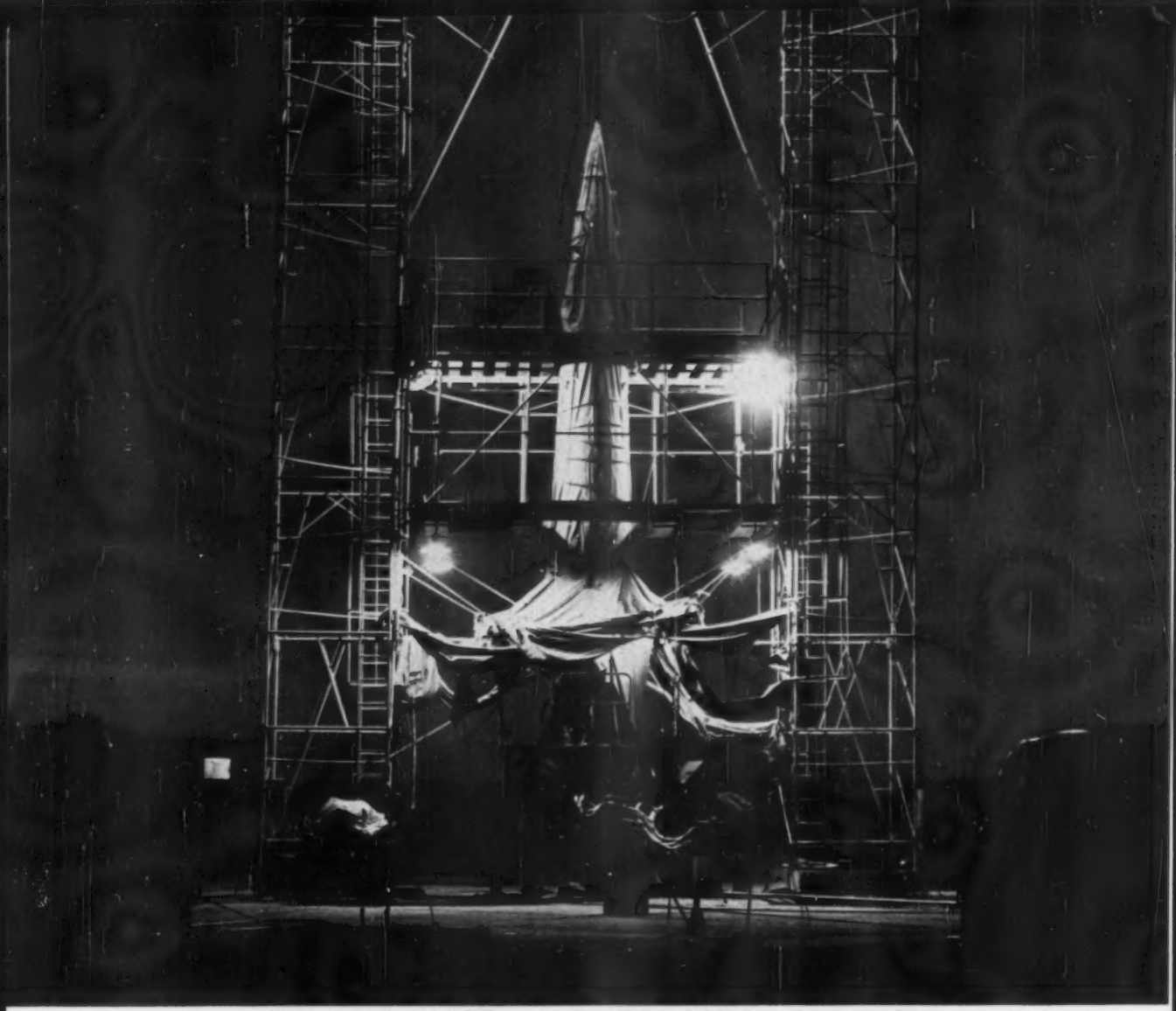
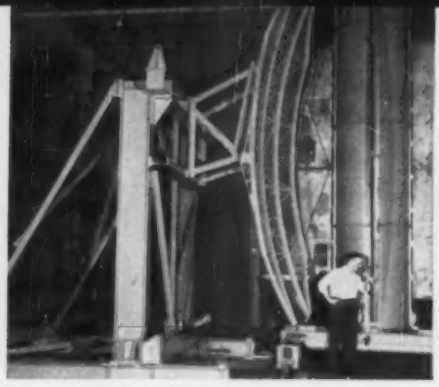


ZERO minus 4 hours! A G-E test missile, still shrouded in the early morning dampness before launching, represents more than a decade of research and development.

THESE G-E CAPABILITIES ARE AVAILABLE TO

BASIC RESEARCH



COMMUNICATIONS

HYPERSONICS

At General Electric, George F. Metcalf reports:

New Department to Help Solve Complex Defense System Problems

GEORGE F. METCALF, is General Manager of General Electric's new Special Defense Projects Department, located in Philadelphia, Pa. Mr. Metcalf has had extensive management experience in the military electronics field, both in Government Service and in the General Electric Company's Electronic Division.

Realizing the increased complexity of some of the nation's current defense system problems, General Electric has formed the Special Defense Projects Department. The new department will act as a Company focal point for large, highly complex missile projects. Headquarters for the new department will be located near Philadelphia, Pa. This new department has responsibility for large defense systems that require the combined research, development, and manufacturing resources of many of General Electric's operating departments and laboratories.

Manned by a highly skilled engineering and development staff, the Special Defense Projects Department relies upon General Electric operating departments and laboratories for many specialized phases of its defense projects.

The Special Defense Projects Department is making significant contributions to America's defense program by focusing the wide range of specialized talents of General Electric on highly complex defense system problems. Section 224-4, General Electric Co., Schenectady 5, N.Y.

ENGINEERS: G.E.'s Special Defense Projects Department is currently expanding its staff of highly skilled engineers and scientists. If you have a background of successful, creative engineering send your qualifications to: Mr. George Metcalf, 3198 Chestnut St., Special Defense Projects Department, General Electric Company, Philadelphia, Pa.

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The "Little David" Catapult is RMI's answer to many launching problems. One of the newest developments of Reaction Motors, Inc. rocket power research, this superior device can be used for a wide variety of launching applications.

RMI, first American rocket engine company, has many other significant "Firsts" in powerplant development, and is a leader in the application of rocket power for . . . Aircraft Powerplants . . . Missile Boosters and Sustainers . . . Auxiliary Power Units . . . and many special related devices.

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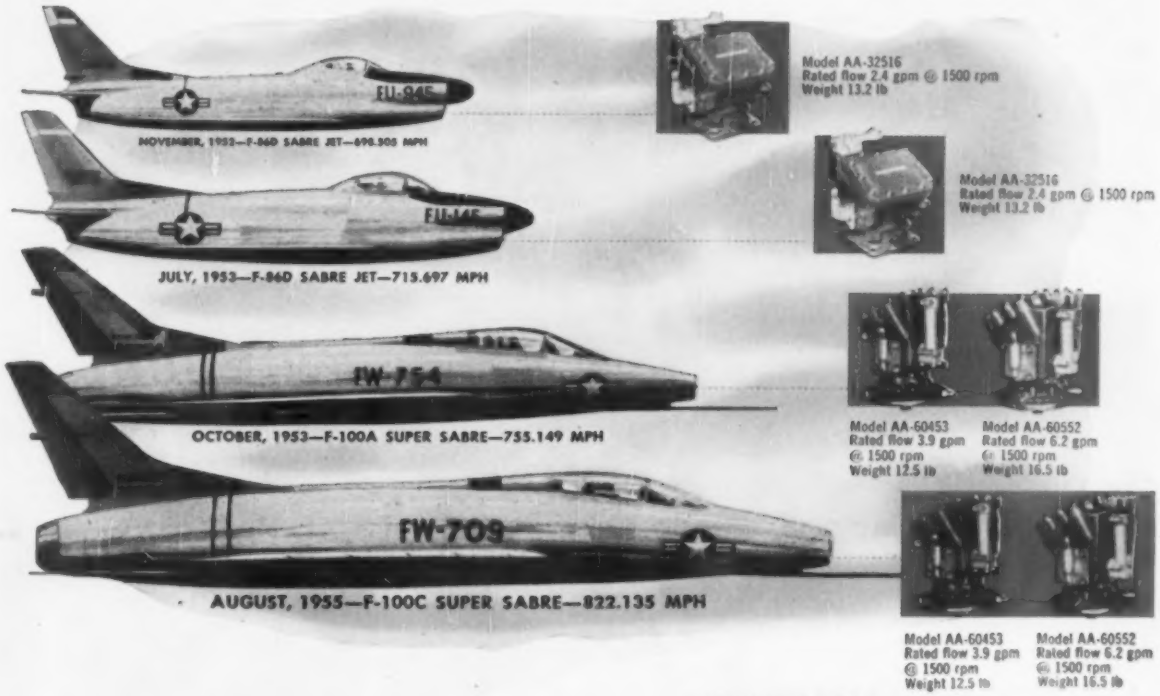

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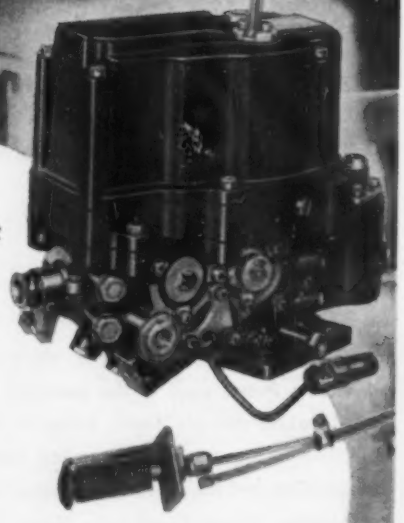

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Bell 47J helicopter uses Western Gear hoist for rescue operations. Bosun's chair or litter can be used.

Closeup of Western Gear hoist installation for Bell 47J helicopter showing compact, lightweight design.

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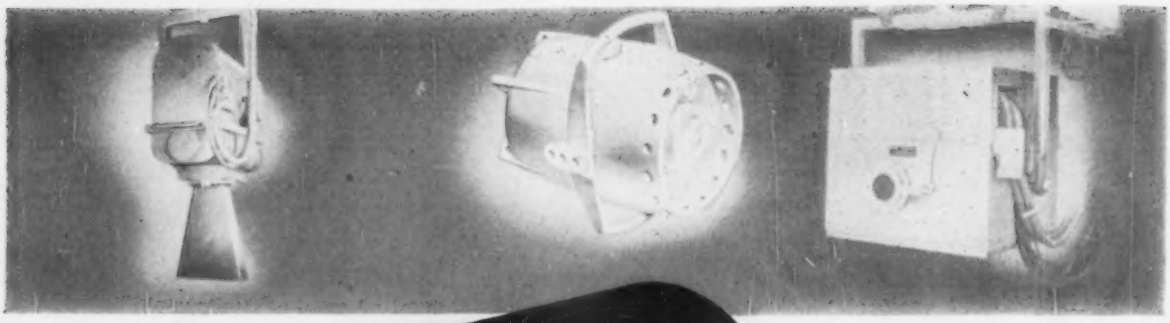

New Kodak X-ray Film

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shorter exposures and quicker examinations

Kodak Industrial X-ray Film, Type AA

Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

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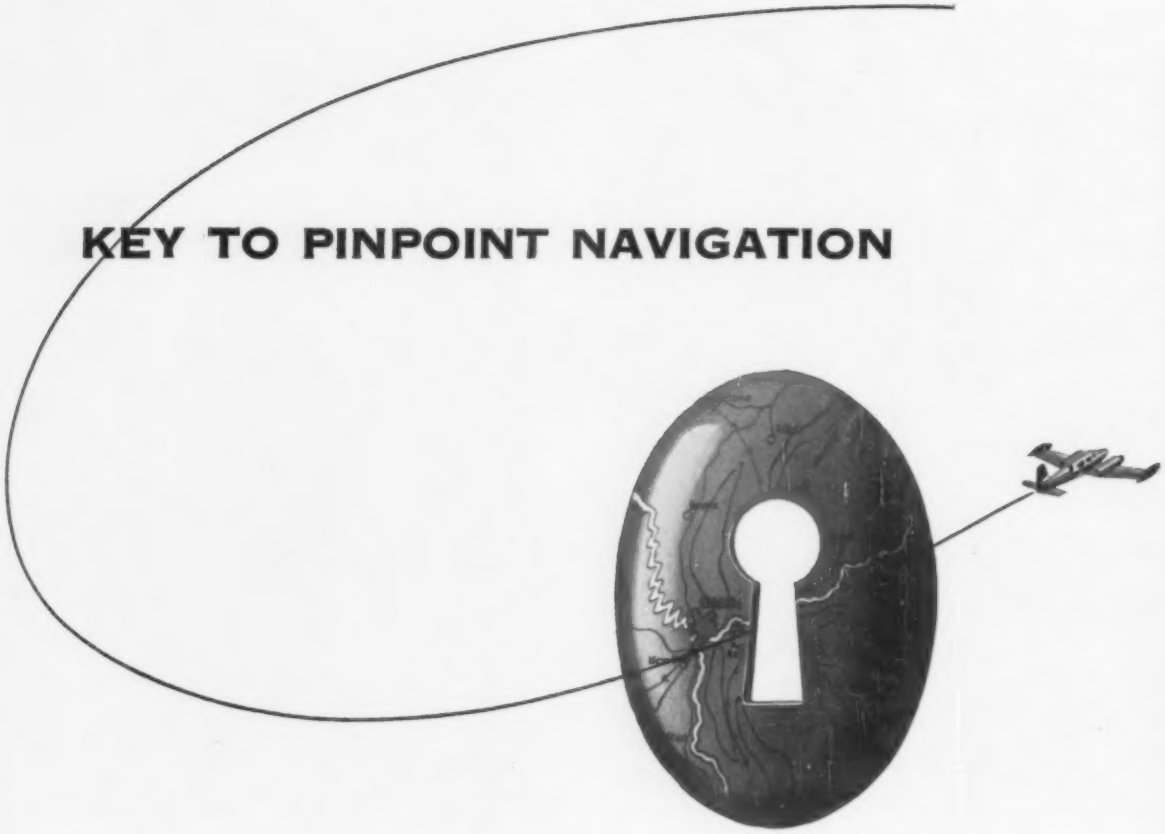
KEY TO PINPOINT NAVIGATION



Omni/ILS Plus ARC's *New Course Director*

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The COURSE DIRECTOR consists of a computer which gives precise steering data and a compass slaved gyro which provides *stabilized*, accurate, directional information.

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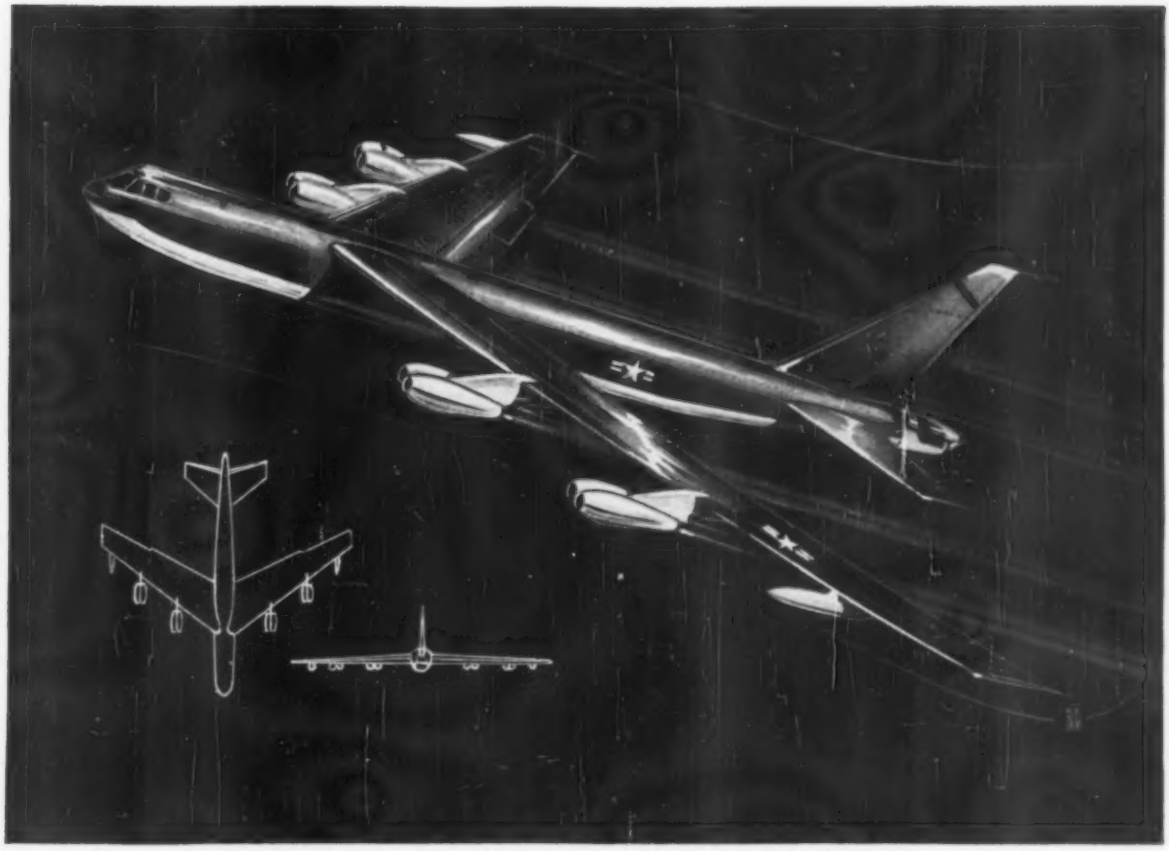

B-52 Stratofortress — This global bomber is powered by eight J-57 turbo-jet engines, paired in sharply raked-forward pods. Her service ceiling is above 50,000 feet.

200 tons that move at nearly the speed of sound

A quick-moving heavyweight is the Boeing Stratofortress.

Late models top 400,000 pounds. But the eight-jet giants push through space at *fighter-fast speed* . . . 650 mph! And enlarged wing-tip tanks add to their specified "very long" range.

The huge B-52 — first jet bomber specifically intended for intercontinental missions — relies on Inco Nickel and Inco Nickel Alloys at critical locations.

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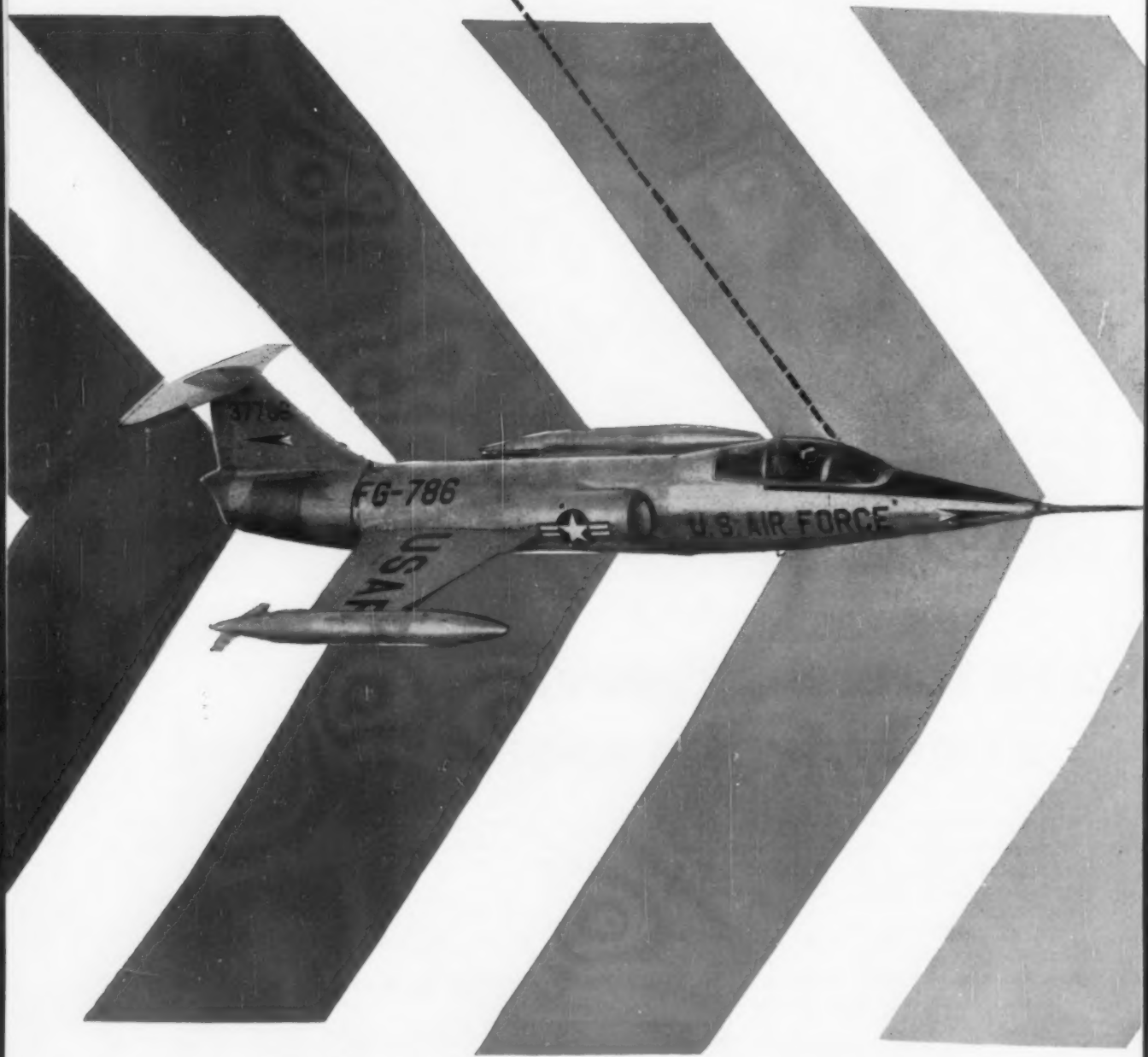

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PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (TECHNICAL) David A. Anderton
WASHINGTON.....Cecil Brownlow
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COVER: Production model of F9F-8 shows underside as it banks over Long Island. Nose probe is for refueling. Angle of picture shows long intake-wing fillet combination, longer than previous Cougar models. Engine is Pratt & Whitney J48-P-8 turbojet rated at 7,200 lb. thrust.

Picture Credits:
26, 27—Robert Hotz; 29—Wide World; 30, 31—CBS Television; 60—Howard Levy; 87—Sovfoto, Wide World.

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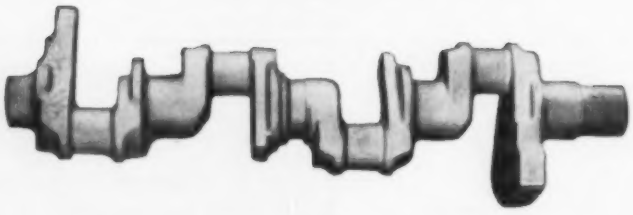
whether you think in terms of

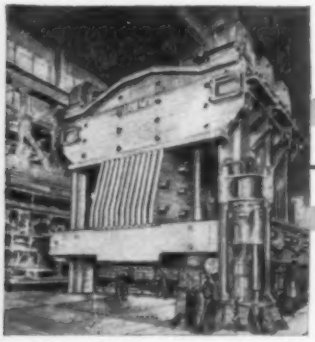
Horsepower

— or —

Thrust



The crankshaft is the backbone of the piston-type engine. Illustrated above is the crankshaft forging for the most powerful piston-type aircraft engine ever produced.



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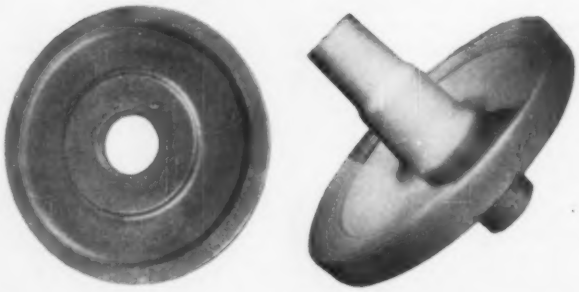
At the bottom left is a turbine disc forging made from high density heat resisting alloy, and next to it is a titanium compressor wheel forging for two of the most powerful jet engines yet produced.



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EDITORIAL

Looking Through the Iron Curtain

The experiences of an American correspondent in the Moscow area during the week of the Tushino air show and the visit of Gen. Nathan F. Twining, USAF chief of staff and his technical experts, provided one of the first good views through the Iron Curtain that has cloaked Russian airpower development since 1945. For at least this period, the Russians made strenuous efforts to convince visiting correspondents that the Iron Curtain has actually dissolved. Even permanent Moscow correspondents for U. S. newspapers indicated that never in post-war history had the Iron Curtain been lowered quite so far.

During this period in Russia, I met and talked with Russian aviation leaders such as Marshal Pavel Zhigarev, chief of the Soviet air force; Andrei Tupolev, dean of Soviet aircraft designers, and members of his staff; Maj. Gen. Beletsky, chief of operations for Aeroflot, the Soviet airline; Col. Victor Danielitiev, chief of Aeroflot's foreign division; Mr. V. P. Stepanoff, vice president of the Central Chaklov Flying Club of Tushino, sponsors of the air show, pilots and navigators of both Aeroflot and the Soviet air force.

I saw the cream of the Soviet air force demonstrate both their operational equipment and their newest experimental types over Tushino. I saw Badger bombers, MiG-15 and MiG-17 fighters, Ilyushin-28 bombers and Tupolev jet transports on the ground and visited model academies where the Russian youths' education in aviation really begins. In addition, there were daily briefings by Gen. Twining.

More important than any of the details seen or heard was the general impression that the Soviet leaders have grasped the full implications of the atomic-airpower age and are engaged in a vast, top-priority program to provide the U.S.S.R. with world leadership in this new technology. It is this feeling that the Soviets are operating at full power and top priority in this field as compared with the "low blower" effort and relatively low priority currently characteristic of the airpower policy of the Eisenhower Administration that seems significant. Gen. Twining grasped this salient point when he asked Communist Party Secretary Nikita Khrushchev to testify before Congress on the scale of the Soviet effort to compete with us both militarily and economically.

There is little doubt that a maximum effort by both the U.S.S.R. and the United States in airpower development would see this country maintain or widen its current margin of superiority over the Russians. However, with the U.S.S.R. making a maximum effort and this country progressing at half steam, our current margin of superiority cannot help but soon diminish and vanish altogether in the near future.

Consider both the scope of the Soviet airpower development displayed at Tushino and the speed of its development cycle as evidenced by the quality of the newest experimental types. The Soviet air force displayed an array of operational types ranging from helicopters that already have set world payload and altitude records, through turbojet transports, supersonic day fighters, light, medium and heavy jet bombers, and on to a transonic all-weather interceptor loaded with airborne radar and rocket armament and a turboprop bomber with intercontinental range. These are all types in production and in operational service with the Soviet air force. The flying demonstrated by the pilots of large formations operating with split-second timing indicated a high level of training in jet and helicopter operations.

Evidence of the Soviet rate of progress in bringing through new developments and keeping pace with the galloping technology of the air age came during the Tushino fly-by of experimental types. Particularly significant was the 1,200 mph. Super Farmer, the new supersonic Yakovlev all-weather fighters and the new supersonic light bomber.

The Super Farmer has been brought along into flight test stage by the design team headed by Artem Mikoyan less than 18 months after the original 900 mph. Farmer design made its first public appearance. Similarly, the design team headed by Yakovlev has produced flight test prototypes of a supersonic all-weather fighter destined to replace the Flashlight within two years after this complex aircraft burst onto the Western world. The new supersonic twin jet bomber indicates the Ilyushin design team has brought forth a replacement for the Il-28 now standard equipment in Soviet and satellite air forces.

Appearance of these three new types shows clearly the Soviets recognize the swift rate of obsolescence modern technical progress imposes on an inventory of military aircraft, and they are not shrinking from the arduous tasks and vast expenditures this rate requires.

It is too early to evaluate the significance of Pavel Sukhoi's delta fighters except that they show the Soviets have not neglected this design approach and are flying prototypes that are certainly supersonic.

In the transport field, the Soviets have at least four new gas turbine powered projects well along including the turboprop Anatov assault transport that flew at Tushino; the Ilyushin 18 turboprop transport whose prototype is nearing completion at Aircraft Assembly Factory 30 in Moscow; the new four jet Tupolev also nearing flight test stage, and an extremely large turboprop transport based on the Bear bomber design. In helicopters, the Yakovlev-24 with its twin engines and 8,000 lb. payload is comparable to anything flying in this country.

General Twining and his party also got a good look at Soviet aviation engineering and military training operations and saw more than anybody outside the Communist bloc has previously seen of engine and aircraft production.

First hand on-the-spot observation of Soviet airpower by both military experts and technical journalists has revealed nothing to contradict the testimony given Congress in recent months concerning the quantity and quality of Russian aircraft. In fact, these observations confirm in every detail the gravity of the competition we face to preserve air superiority.

—Robert Hotz

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WHO'S WHERE

In the Front Office

Harold E. (Hap) Herdrich, director of master planning, Northrop Aircraft, Inc., Hawthorne, Calif. Also: **Roland J. Pagen,** finance committee chairman. Pagen will retire as vice president-treasurer July 31; succeeding him as treasurer: **Charles C. Cilley. Harry J. Schwartz,** chief, new ground support and test equipment department to meet SM-62 Snark requirements.

Ira J. (Ike) Kaar, vice president-engineering director, Hoffman Electronics Corp., Los Angeles, Calif.

Dan W. Burns, vice president-general manager, Hufford Machine Works, Inc., El Segundo, Calif.

Harry H. Wetzel, Jr., assistant to the president, the Garrett Corp., Los Angeles, Calif.

Honors and Elections

Theodore E. Dinsmoor, planning director, defense products group, American Machine & Foundry Co., received the U. S. Defense Department's distinguished civilian service award for "outstanding contributions to the underwater ordnance field."

Ezra Kotcher, technical director, Wright Air Development Center's Directorate of Development, received the National Civil Service League's Career Service Award for 1956.

Gerald L. MacInnis, Maritime Central Airways pilot, received Canada's McKee Trophy for "outstanding work in connection with the distant early warning line."

Roger C. Fleming, public relations director, Allison Division, General Motors Corp., elected chairman of Aircraft Industries' Public Relations Advisory Committee for 1956-1957.

A $250 annual award has been established by the Council of the Institute of the Aeronautical Sciences, to be awarded to the individual making the outstanding contribution to seaplane design each year. An anonymous donor contributed $20,000 to establish the award.

Changes

Edward L. Hradesky, sales coordinator-guided missile program, Loewy-Hydropress Division, Baldwin-Lima-Hamilton, New York, N. Y.

Dr. Robert O. Fehr, manager, General Electric Co.'s mechanical engineering laboratory, Schenectady, N. Y.

Wilbur C. Broyles, plant manager, Aircraft Products Division, Kawneer Co., Niles, Mich.

Dr. John L. Miller, defense activities director, Firestone Tire & Rubber Co., Akron, Ohio.

G. E. Lowdell, after-sales service, Vickers-Armstrongs (aircraft) Ltd., London, England.

Paul Miscione, Pan American World Airways representative, Bangkok, Thailand.

J. J. Sullivan, manager, Silver Battery Division, Exide Industrial Division, Philadelphia, Pa.

(Continued on page 88)

INDUSTRY OBSERVER

(The following column was written by Aviation Week *Editor Robert Hotz from Moscow where he witnessed the Tushino air show and interviewed Russian aviation leaders.)*

► Tupolev Tu-104 twin jet transport now being readied for service with Aeroflot, the Soviet airline, is much larger than the Badger bomber although their planforms are similar. Good opportunity for comparison of these two aircraft was afforded observers at Moscow's Vnukovo Airport where several Tu-104s were parked next to a Badger being used to check out Aeroflot crews on jet operations. Badger wing span is less than that of the Tupolev transport, and the bomber's landing gear is much shorter than the transport, putting the slim Badger fuselage closer to the ground. Difference in fuselage size is much more than would be necessary in a simple transition from bomber to transport on the same scale. Badger still retains B-29-type tail turret armament.

► MiG-17s observed on several airdromes had three wing fences on each wing with one extremely close to the fuselage on each side and two spaced closely together about half way down the span of the swept wing. MiG-17 also has an afterburner fitted to its RD45 centrifugal flow turbojet giving total thrust of slightly more than 7,000 lb. Air intake of the current MiG-15 is noticeably larger than on the earlier MiG-15.

► Radar installations for both military and civil use are very much in evidence around Russian airdromes. Mobile search radars combine search and altitude functions in a single set featuring unusually large antennas for mobile units. Portable huts built on the module principle house radar scopes, communications equipment, crews and power supply. Caterpillar tracked vehicles are provided with these units for transport.

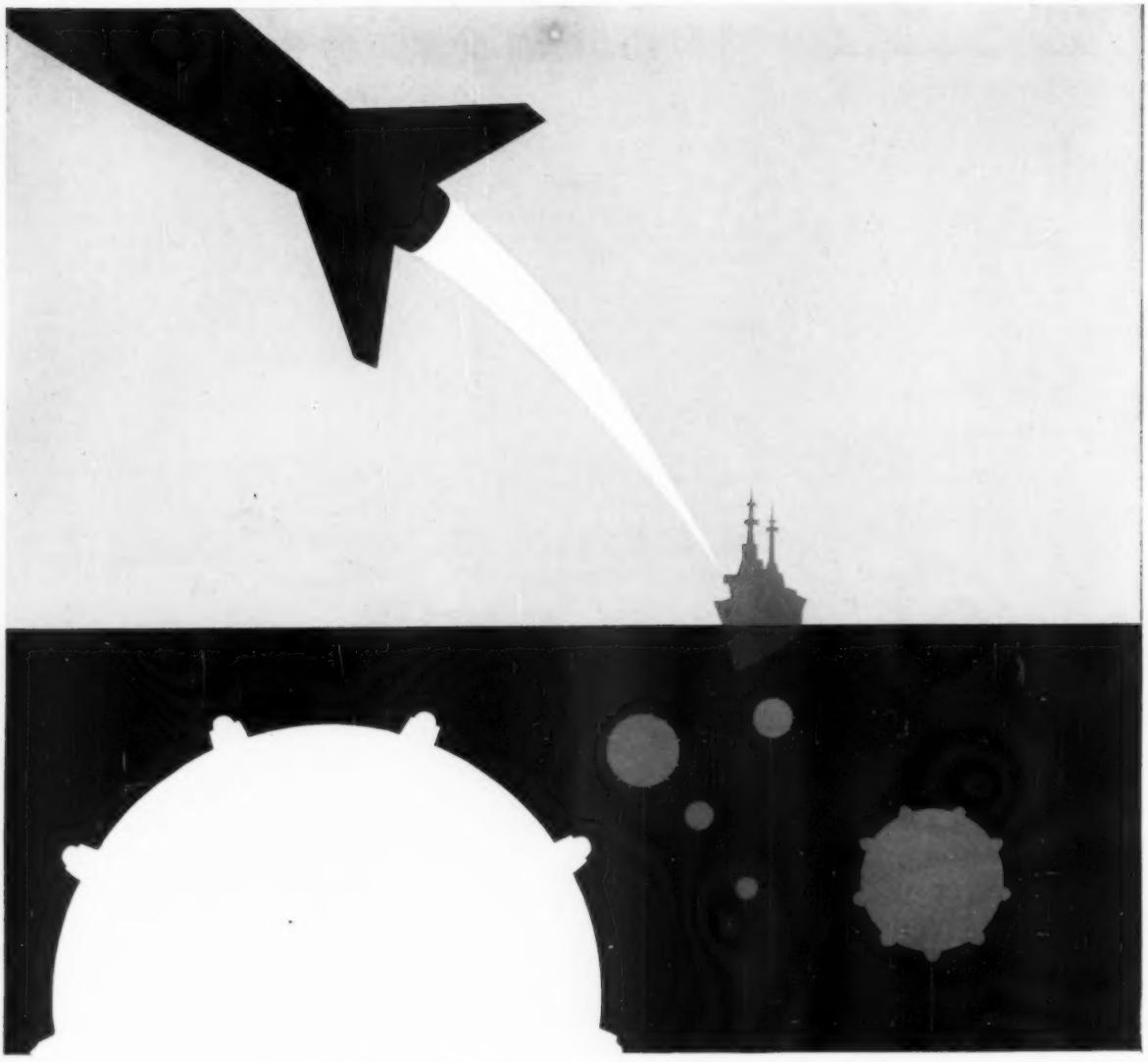
► Soviet air force and Aeroflot use 100/30 octane gasoline. Analysis by western sources supported this octane rating but revealed unusually large percentages of lead additive which causes excessive spark plug fouling on Western-type equipment. Plugs with softer points are necessary when using Russian gasoline.

► Russian references to Artem Mikoyan as the designer of the Farmer 900 mph. day fighter and the 1,200 mph. Super Farmer indicate that the design team of Mikoyan and Gurevich made famous by the MiG-15 during the Korean war may have been dissolved. No references to recent work by Gurevich appear in Russian newspapers or aviation magazines.

► Some operational fighter groups of the Soviet air force have adopted a new paint scheme using a broad red stripe down the trailing edge of the vertical fin and extending forward along the top of the fuselage to the nose. This color scheme was used on the Fresco (MiG-17) and Farmer (MiG-19) types doing formation aerobatics at the Tushino show and appears in color illustrations in Russian magazines describing Fresco units.

► Concrete runways 5,000 to 8,000 ft. long are in evidence on airfields throughout western Russia. Older runways were laid in an octagonal pattern of concrete forms, but newer runways are laid in large square slabs. Pattern of taxiways around military airfields indicates widespread dispersal areas well concealed from normal observation. Soviet air force also has operated MiG-15 and MiG-17 type fighter squadrons off unimproved grass strips providing a degree of mobility much greater than that possible with similar USAF types such as the F-86 and straight-wing F-84 types.

► Radar ground controlled approach (GCA) is the primary Soviet air force and Aeroflot bad weather landing aid. GCA equipment of Russian design and looking radically different from U. S. types is in evidence on all airports observed between Riga and Moscow. Soviets also have developed an ILS-type beam landing system operating on a different frequency than Western types. Russian ILS also has four fan markers compared with three on western systems. Cockpit crosspointer indicators for Russian ILS are about the same as Western types.



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WASHINGTON ROUNDUP

A Shock for NATO

Defense and State Department efforts to bolster waning European enthusiasm for the North Atlantic Treaty Organization were jarred by the release of testimony Lt. Gen. James M. Gavin, Army research and development chief, gave before the Senate Airpower Investigating Subcommittee. Said Gavin in part:

Fallout from an all-out U. S. nuclear attack against the Soviet Union would result in the deaths of hundreds of millions of people. Millions of these probably would be allies—"If the wind blew southeast . . . they (the deaths) would extend well back up into the Philippine area. If the wind blew the other way, they would extend well back up into Western Europe."

Vice Adm. Arthur C. Davis, who has censored the subcommittee's closed-door testimony prior to its release for publication, allowed the testimony to pass, a spokesman said, because he felt the wide-spread deadlines of radioactive fallout was well known. But even subcommittee member Sen. Henry M. Jackson (D.-Wash.) was surprised. "I am shocked," he said, "at what the Department of Defense has released, not from the standpoint of security but from the standpoint of our friends throughout the world."

Sledge Hammer and Sky Cav II

Pending final settlement of its feud with the Air Force over air missions and equipment, the U. S. Army has moved quietly to activate a new unit called Sky Cav II and has scheduled it for an important role in Exercise Sledge Hammer to be staged at Ft. Polk, La., next February and March. Ft. Polk was the scene, last fall of Exercise Sagebrush where utilization of Sky Cav I provoked a row with the USAF that had to be settled by the service secretaries in the Pentagon. Sky Cav I included helicopters and light planes. Its mission was primarily reconnaissance.

The Army is close-mouthed about Sky Cav II, saying only that it is too highly classified to discuss. At the same time, it has joined with the Navy in lifting wraps from three-year-old Kaman drone helicopter.

Army says its use of drone could include operation of remote television cameras from behind front lines, carrying cargo and other missions related to Sky Cav operation during Sagebrush.

Plans for next year's Sledge Hammer call for troop tests of engineer assault equipment and aerial resupply of armor. There is no indication that the Army expects to exploit the USAF's C-123 assault transport, despite the fact that planes and crews are being trained at Ardmore, Okla., to provide support for Army exercises.

More Defense Secretaries?

The House last week overwhelmingly approved legislation authorizing a new assistant defense secretary for research and development for each of the three services, but its chance of enactment is practically zero. (Since the Air Force already has assigned one of its undesignated assistant secretaries to research and development, the effect of the legislation on the USAF would be to give legal status to the assistant secretary for research and development and permit a new assistant secretary for installations.)

The Senate has cold-shouldered the President's request for the legislation, recommended to him for submission to Congress by Secretary of Defense Charles Wilson, and it has not even been introduced on the floor.

Satellite Research

An Air Force general working on urgent research and development projects doesn't get all of his frustrations from red tape and a restricted budget. For example, Lt. Gen. Donald L. Putt, USAF's Deputy Chief of Staff for Development, recently received in the mail a salt and pepper shaker set. Covering letter from a Florida novelty manufacturer requested information on the shape, color and markings of the U.S. satellite to be launched next year. Gen. Putt was asked to provide data for production of a salt and pepper set with the satellite motif.

New Challenge to Wilson

The Senate Airpower Investigating Subcommittee is expected to call new sessions with Gen. Nathan F. Twining, USAF Chief of Staff, and Allen Dulles, director of Central Intelligence Agency in view of the testimony of Defense Secretary Charles Wilson (see page 29). The subcommittee's chairman, Sen. Stuart Symington (D.-Mo.) charges "serious differences of fact" in Wilson's testimony backing the Administration's defense program with previous testimony given by Twining and Dulles.

The subcommittee is expected to make two reports on the airpower situation—one signed by the three Democratic members objecting to the Administration's program; the other by Republican members supporting it.

Quarles Intellectually Honest

Secretary of the Air Force Donald Quarles won the compliments of the three Democratic members for his testimony before the Senate Air Power Investigating Subcommittee (AW July 2, p. 31). Sen. Henry Jackson (D.-Wash.) noted differences of opinion but praised Quarles for being "intellectually honest."

Under questioning, Quarles said that the focusing of public attention on airpower by Congress and Trevor Gardner had had "a very wise influence." Gardner resigned as assistant secretary of the Air Force for research and development in February in protest over the budget limits on the R & D program.

CAA To Study Comet, Caravelle

A team of Civil Aeronautics Administration engineers will be sent abroad within the next few months to evaluate the de Havilland Comet 4, Bristol Britannia and some 25 other foreign aircraft for U. S. certification. A preliminary Type Board meeting will be established in England for the purpose of making the studies. Formal application for the Comet certification was received last month by the CAA from de Havilland Aircraft Company through Air Registration Board channels.

Included in the evaluation will be the Caravelle jet transport and the Fokker Friendship. Recent modifications of the Vickers Viscount also will be brought under study by the CAA group.

—Washington staff

TUPOLEV TU-104 twin-jet transport No. 27 is on ramp in front of Moscow terminal prior to proving flights to Omsk and Khabarovsk.

Aeroflot Plans International Jet Routes

Soviet airline pushes turbine transport plans, seeks routes to Western Europe, North America.

By Robert Hotz

Moscow—Aeroflot, government-owned airline of the Soviet Union, is planning a major expansion based upon new turbine-powered equipment and new traffic routes to Asia, Western Europe and North America.

This was revealed by Maj. Gen. Beletsky, Aeroflot operations chief, and Col. Victor Danielitiev, chief of Aeroflot's foreign division, in an interview with AVIATION WEEK in the airline's Moscow headquarters.

Aeroflot, which is headed by Air Marshal S. J. Zjavoronkov, is one of the world's largest airlines operating routes equivalent to Pan American World Airways' 63,000 unduplicated route-miles with a fleet of 900 Ilyushin twin-engine transports, at least another 500 15-passenger DC-3 type Li-2s and 10-passenger Antonov Colts, plus assorted agricultural-type spray and liaison planes. In addition to its extensive airline operations, Aeroflot also builds and operates civil airports, communications and landing aids; trains pilots, air crews and communications personnel; conducts all agricultural spraying and pest control operations, and is responsible for medical and scientific research in civil aviation.

ROBERT HOTZ, editor of Aviation Week in front of terminal building at Vnukovo.

Jet Age for Aeroflot

In its transport operations, Aeroflot is now engaged in jumping from a DC-3 type of operation over primarily domestic routes to the jet age and international routes. Among the new types of gas turbine-powered equipment Aeroflot plans for its future operations are:

• **Tu-104 twin-jet** 40-passenger turbojet airliner now about to enter Aeroflot service on the Moscow Orient express route to Khabarovsk in Siberia. The Tu-104, of which ten are now flying, is still in the final stages of proving operations on the Orient route. Eventually, Tu-104 operations will be extended to Prague in Western Europe and Peking in China. Maj. Gen. Beletsky told AVIATION WEEK that Aeroflot is encountering "technical difficulties" with the Tu-104 but added that they were the normal type of "bugs" encountered in getting any new type of aircraft fully operational.

• **Antonov twin-turboprop transport** will be adapted for Aeroflot operations as a cargo plane, General Beletsky said Aeroflot already had a heavy demand for all-cargo services within the Soviet Union but was handicapped by the small doors and limited capacity of the Li-2 and Il -12 equipment now available for such service.

• **Tupolev four-jet long-range** transport for international routes to Asia and North America. This plane, believed

ILYUSHIN IL-14 TRANSPORT at Moscow's Vnukovo airport serves on Aeroflot's long routes. Soviet government uses it also for VIPs.

to be based on the Bison bomber design but considerably scaled up in size, is billed by its designer Andrei Tupolev as a 170-passenger transport. Prototype is virtually completed and is expected to fly soon.

• **Ilyushin 18 turboprop transport** with a 70-passenger capacity aimed at medium stage length routes. Prototype of the Il-18 is nearing completion at Aircraft Assembly Plant No. 30 near Moscow's Central Airport and is expected to fly this summer. It is a low mounted swept-wing design powered by four turboprop engines.

• **Large turboprop transport** based on the Bear bomber design. This is aimed at long-range, high-density routes. Little is known about the progress of this project.

Aeroflot has gained its initial jet operational experience with the Il-20 twin jet version of the Il-28 light bomber. The Il-20 has been operating on a high priority cargo, mail and newspaper matrix run from Moscow to Siberia for about 12 months. Aeroflot also has a Badger medium bomber based at Vnukovo for transition training of crews in jet operations.

The five-year plan recently announced at the 20th Congress of the Communist Party calls for Aeroflot to increase its cargo capacity by 500% and its passenger traffic by 380%. Much of the passenger increase is expected to come from expansion of international routes. Aeroflot now has bi-lateral agreements with 22 foreign countries, most of them Communist satellites.

Most recent agreement was signed with the East German government in late June.

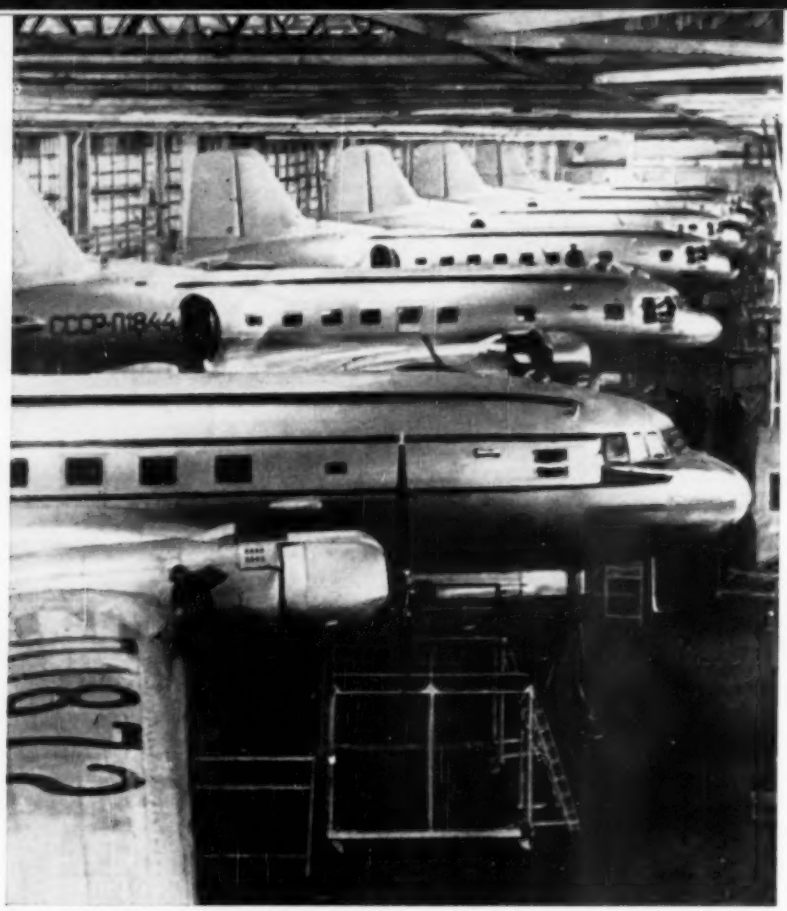
Next on the Aeroflot agenda is Pan American World Airways. The airline is expected to send a technical mission to Moscow in mid-July. It will be followed by Pan American President Juan Trippe who will negotiate a traffic agreement.

General Beletsky told AVIATION WEEK that Aeroflot's bilateral policy is based upon reciprocity, and the Soviet airline expects to fly into any country to which it grants Russian traffic privileges. He acknowledged that Aeroflot would need new equipment—either the four-jet Tupolev or the large turboprop transport—to enter the transatlantic traffic competition. However, General Beletsky said that when this equipment becomes available, probably within the next two years, Aeroflot definitely plans to fly to North America.

It would be surprising if the Soviets, who have extensive experience in Arctic aviation operations, were not interested in Polar routes to North America. They already are using their connecting link from Moscow via Aeroflot and Scandanavian Airlines System to route considerable mail and cargo over the SAS polar route to Los Angeles.

In addition to the western European satellite countries, Aeroflot now operates international services to Peking, China; Kabul, Afganistan, and the Scandanavian terminals of Helsinki, Stockholm and Copenhagen. Heaviest Aeroflot traffic now flows over its Siberian route from Moscow to Khabarovsk. Col. Danichitiev told AVIATION WEEK that Aeroflot's foreign traffic has increased 30% annually for the past three years with indications of even heavier increases since trade barriers have been lowered between western Europe and China. Aeroflot now operates up to four planes nightly on a 32-hour service from Moscow to

INTERIOR OF CIVIL AIR TERMINAL at Vnukovo Airport, 20 miles south of the Soviet capital, has wooden benches, large statute of Stalin and a wall relief map of Aeroflot's routes.



IL-14 AIRLINERS are on final assembly line at Aircraft Plant No. 30 at Moscow Central Airport. This factory, oldest aircraft plant in Russia, was inspected by Gen. Nathan F. Twining, USAF chief of staff, during his visit to Russia (AW July 2, p. 29). Eighteen and 24-passenger models of the Il-14 are being manufactured.

Peking, including an eight-hour sleep for passengers on the ground at the border airport of Irkutsk. Original weekly service to Kabul was recently doubled.

Load factor on the eight weekly flights from Moscow to Scandanavia have been averaging 82% since the routes opened last spring, with seats hard to get during the summer tourist season. Overflow traffic on this route is spilling onto the Aeroflot and Czech airline services to Prague where connections to western Europe are available via KLM, British European Airways and Sabena. Cargo traffic is developing slowly from Moscow to the West with printed material the main commodity now moving by air freight.

Tourist Service Plans

Aeroflot now operates a 21-passenger version of the Il-12 on its routes to Stockholm and Copenhagen. SAS operates a 24-passenger Scandia while Finnair flies a 44-passenger Convair 440 from Helsinki to Moscow. When SAS negotiated its Moscow traffic rights, it was limited to operating equipment comparable to that of Aeroflot. But, with the rapidly increasing traffic demands, it appears that this condition will not be imposed on Pan American. Vnukovo, Moscow's main civil airport, is suitable for DC-6 and Constellation operations. Since the opening of SAS-Aeroflot service to Stockholm and Copenhagen, the airport at Riga has become the border station and refueling stop for the Il-12 and Scandia operations.

Aeroflot now operates one class service but will go to tourist and first-class distinctions when it puts its big jet transports into service. Col. Danielitiev also told AVIATION WEEK that Aeroflot is making a detailed study of both International Civil Aviation Organization and International Air Transport Association regulations and would decide whether to join these organizations after this study is completed.

Report From Russia

This is the first of two articles by Aviation Week Editor Robert Hotz on the operations and future plans of Aeroflot, the government-owned airline of the Soviet Union and one of the key factors in the current Soviet policy of lowering the Iron Curtain to permit an increased flow of international traffic to the West. These articles are based on interviews with Aeroflot officials in Moscow, travel on its services and observations of its operations at airports in western Russia.

Navy Announces Order For Temco Jet Trainer

Temco Aircraft Corp., of Dallas, has received a Navy Bureau of Aeronautics' contract to build an "evaluation quantity" of the Temco Model 51 primary jet trainer.

The contract, designed to provide the Navy with its first primary jet trainer, also represents the first production order Temco has received for a complete aircraft of its own design. First delivery is scheduled for July, 1957.

The Model 51, built and flight tested by Temco at its own expense, was accepted by the Navy after competitive evaluation tests at the Naval Air Test Center, Patuxent River, Md.

Powered by a Continental YJ69-T-9 engine rated at 920 lb. thrust, the aircraft has several characteristics of standard jet fighters, including ejection seats, liquid oxygen equipment and speed brake. With a maximum speed of almost 300 knots, it can land at 62 knots.

Temco engineers say the Model 51 can take off over a 50-ft. obstacle in 3,000 ft. Endurance at sea level is one and one-half hours; the service ceiling is 30,000 ft.

Cable Error

Due to an error in cable transmission from Moscow, the new supersonic Yakovlev all-weather fighter was labeled a Super Farmer in last week's special report on the Soviet airshow at Tushino (AW July 7, p. 26). The Super Farmer is a Mikoyan design. It is an improvement over the original Farmer day fighter and has a top speed in the 1,200 mph. class.

The new Yakovlev supersonic all-weather fighter flew in two versions at Tushino. One had a needle nose gray radar indicating all-weather functions. The other had a plastic, bombardier-type nose indicating use as a light bomber or attack plane. The new Yakovlev all-weather fighter is about the same size as the earlier transonic Flashlight but has a higher degree of wing sweepback, more powerful jet engines and an extremely clean, round fuselage design (see p. 30).

Wilson Faces Symington, Defends Policy

By Katherine Johnsen

Washington—Secretary of Defense Charles E. Wilson, testifying in the face of challenging testimony from Air Force leaders, defended the Administration's airpower program "without reservations" during hearings last week before the Senate Airpower Investigating Subcommittee.

At the conclusion of the hearings, subcommittee chairman Sen. Stuart Symington (D.-Mo.), declared that Wilson's sworn testimony was "inconsistent" with that given earlier by Gen. Nathan F. Twining, USAF chief of staff; Allen Dulles, head of Central Intelligence Agency and other leaders. From this, Symington maintained, it could only be deduced that either the military leaders "shaded" or "distorted" their testimony for their own service ends, or that Wilson had "shaded" or "distorted" his testimony for "partisanship" to support the Administration's fiscal policy of holding down expenditures.

"There is fact, interpretation and opinion," Wilson replied. "We don't all agree on the interpretation, and opinion." He said he had encouraged military leaders to testify before the subcommittee "to the best of their knowledge and ability what they believed" and "did not attempt to guide anyone."

Symington countered that there are "serious differences of fact" between the sworn testimony of Wilson and the military leaders.

Wilson Challenges LeMay

Non-classified testimony which Wilson challenged included:

• **Statement of Gen. Curtis LeMay,** commander of the Strategic Air Command, that, under the present U. S. program, strategic bombing superiority will pass to Russia within four years. Wilson said Gen. LeMay had not considered the recent increase in B-52 production from a planned 17 a month to a planned 20, the B-47 striking force or actions which may be taken in connection with the Fiscal 1958 budget which could affect the picture within a few years.

• **Gen. LeMay's assertion** that Russia's long-range jet bomber, the Bison, is "comparable" to the B-52. Wilson said the B-52 is "greatly superior in speed, combat range, and combat ceiling."

• **Testimony of Lt. Gen. Donald Putt,** deputy chief of staff for research and development, that budget ceilings are delaying key defense projects. Wilson said "no important research and development projects have been delayed over the past three years" because of monetary limitations. He said "pure research" on the atomic-powered aircraft project "never stopped" as charged by Sen. Symington. Developmental work was suspended in 1953, he said, because research pointed to more desirable approaches. If this had not been done, he added, an atomic-powered plane which "would fly but be of no military use" would have resulted.

• **Statement of Gen. Twining** that, in numbers of planes, production and rate of progress, the U. S. is "falling far behind" Russia. Wilson emphasized that Russia started its airpower buildup from a far inferior position to that of the U. S. Although "they are catching up," he said, "I don't think we are falling behind. . . . The U. S. is still clearly superior. Our rate of progress in air power is very rapid."

House Passes Budget

Two developments on the airpower budget in Congress last week were:

• **The House reluctantly** went along with a $900 million increase in USAF funds for aircraft procurement already voted by the Senate in giving final approval to the $34.6 billion defense budget for Fiscal 1957. At the insistence of the House, a provision was accepted making it clear that the additional funds might be used to expedite the production of heavy bombers, tankers and other essential Air Force weapons "to the optimum limit of existing facilities." The provision originally accepted by the Senate directed that the funds were to be used "primarily" for B-52 production.

At House insistence, a provision also was adopted that the $800 million increase—over and above the Administration's recommendation—"should not be interpreted as an invitation toward waste and loose fiscal procedures. . . ."

The additional $100 million voted by the Senate for USAF research and development was approved by the House.

• **Secretary Wilson made a "guess"** that USAF's Fiscal 1958 budget would increase from $1 to $2 billion over the $16.4 billion appropriation for Fiscal 1957. Proposals that will be considered in connection with this budget, Wilson disclosed, include an increase in planned B-52 bomber wings from 11 to 17 and a boost increase in overall B-52 production, an increase in USAF tanker production and in airlift for the Army.

The proposal for the increase in B-52 wings has been formally presented by Gen. Twining. Wilson reported that both he and Gen. Twining consider the presently planned production of 20 a month for B-52s the desirable optimum. He told the subcommittee, however, that in view of the congressional increase in funds for the Stratofortress he would review the situation and consult with Gen. Twining upon the latter's return from Moscow where he viewed the Soviet's June 24 air show (AW July 2, p. 26).

The Democratic manager of the defense budget on the House side—Rep. George Mahon (D.-Tex.), chairman of the Appropriations Subcommittee on the Armed Services—was critical of the action of Democratic senators in boosting Air Force funds.

Apparently referring to the Syming-

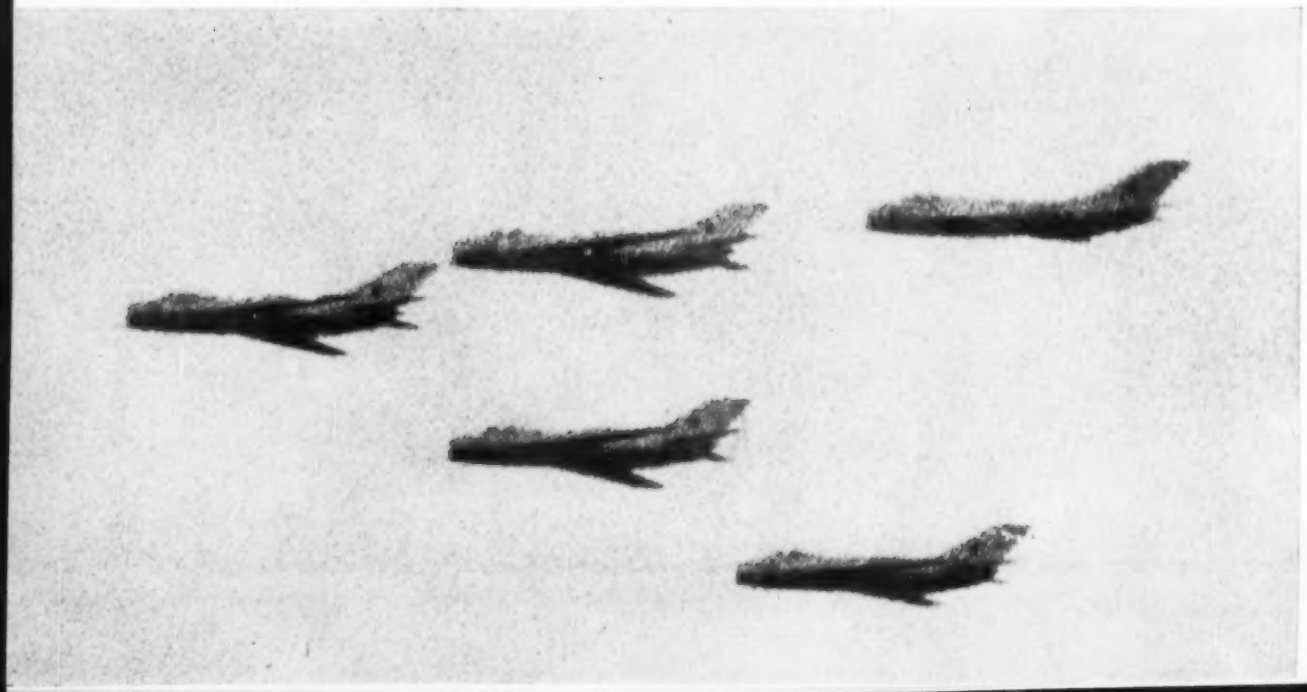
Wilson on Defense

Secretary of Defense Wilson reading testimony before Senate Armed Service Subcommittee with Adm. Arthur Radford, chairman of the joint chiefs of staffs, by his side. Wilson defended the Eisenhower Administration's airpower policies "without reservations."

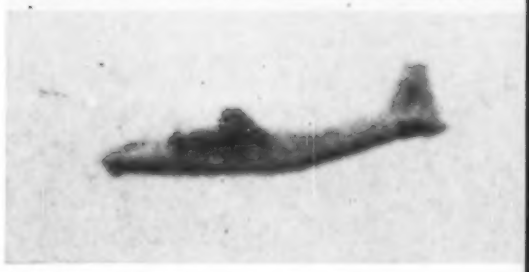
NEW SUPERSONIC YAKOVLEV all-weather fighter flew in the Tushino air show. Note pointed radome nose. Cranked wing uses one angle of sweep back from fuselage to engine nacelle and another from nacelle to wing tip. Wings are squared off with air speed pitot tubes at tips. Dark spot under fuselage probably is a rocket-firing pan. Large intakes are for 10,000 lb. thrust axial jet engines. Photo foreshortens fuselage obscuring its slim, clean lines.

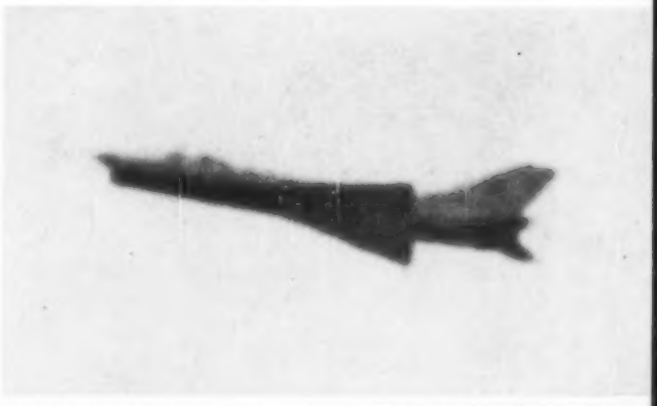
Russia Shows Off New Aircraft

SUPER FARMER, designed by Mikoyan, in Tushino fly-by (left) shows larger fuselage and air intake from standard Farmer, more vertical tail and dorsal fairing. It is in 1,200-mph. class. Note the high degree of wing sweep back on operational Farmers in Tushino formation (below). Relatively high-aspect ratio wing is for extreme altitude performance. Long flat lines of fuselage contrast with barrel shape of MiG-15 and MiG-17.

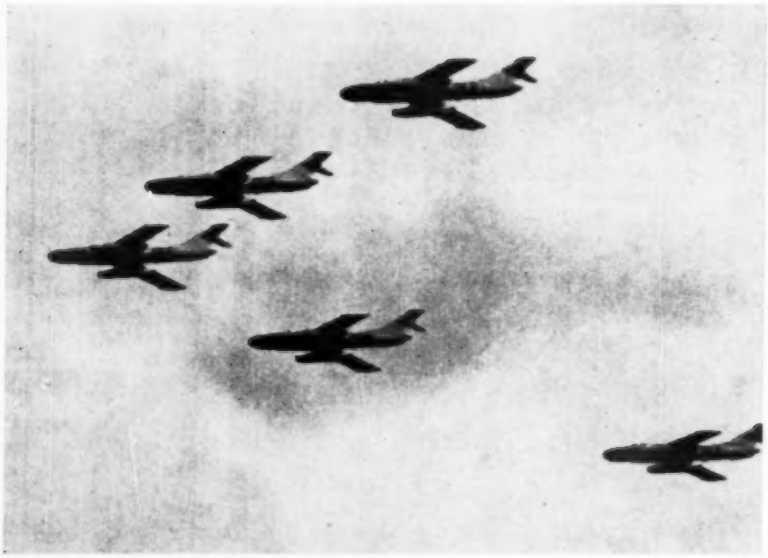


ANTONOV ASSAULT TRANSPORT, powered by two turboprop engines, has box-car fuselage. Upswept aft section of fuselage permits rear loading from truck-bed level. Bulges along bottom of fuselage house landing gear. Navigation radome bulges under the nose. Design, with large vertical fin, is strikingly similar to Stroukoff-designed C-123, now being built by Fairchild. Side view of Antonov transport (right) shows long fuselage, which stretches a "size larger" than the C-123 but is not quite as large as the Lockheed C-130. Slim nacelles house 4,000-eshp. turboprop engines.





THREE VERSIONS OF PAVEL SUKHOI'S supersonic experimental delta fighters flew in the Russian air show. One delta prototype (left) has pointed radome nose with large air intake beneath, like the Chance Vought Crusader. Air speed pitot tube extends from the nose similar to that on the North American F-100. Note the large wing area provided by extremely thin delta wing, low set horizontal fin and large vertical fin. Large diameter of tailpipe indicates Sukhoi delta is equipped with afterburner; afterburners were not used during the Tushino flyby. Side view (top right) shows large vertical fin and low mounting of horizontal fin. Another Sukhoi delta (bottom right) has large air intake but no radome nose. Conventional empennage is squeezed closer to delta wing, shortening fuselage. A third version flown has no fuselage extension aft of trailing edge delta. It has a large vertical fin with horizontal tail mounted half-way up. All three exhibited fast rates of climb without afterburners.



FORMATION OF FLASHLIGHTS taken by Russian photographer shows slim fuselage lines and tail fairing to improve aerodynamic flow. Mounting of horizontal stabilizer at midpoint of sharply sweptback tail is typical of earlier Soviet transonic designs. Long, slim pods house 8,000-lb. thrust axial turbojets.

BEAR TURBOPROP bomber is escorted by MiG-17 Fresco fighters. Tail armament and contrarotating propellers are clearly visible. Fresco fighters appear to have horizontal tail mounted on top of vertical fin. Bear fuselage, also, has long, clean lines.

ton subcommittee, Mahon declared in a floor speech before the final approval of the budget increase:

"Asking a military man how much defense he would like to have is like asking how deep is the ocean, how high is the sky? . . .

"There seems to be an assumption that when you think about national defense you should not consider economy, fiscal or budgetary matters. I violently disagree with that opinion. National defense, to be effective, must take into consideration the economic structure, the taxpayer and the survival of our way of life while we seek to maintain peace."

An official USAF statement as to how an additional $1 billion would be spent, Mahon reported, showed that the Air Force would not spend additional money in the areas voted by the Senate.

For aircraft procurement, the representative said, the USAF would use $200 million. "So we are giving $600 million more than the Air Force officially advocates."

The USAF has said it could use an additional $400 million for construction of bases, Mahon continued, "but there was not a dime for this" voted by the Senate.

Mahon also pointed out that the USAF recommends an additional $200 million for research and development but that the Senate voted only an additional $100 million.

While Senators Symington and Henry Jackson (D.-Wash.) were insisting that Secretary Wilson move to step up B-52 production, Mahon warned the House against a "crash" program. Mahon said that there is "logic" to the Defense Department's plan "to proceed on a graduated basis, phasing in the new things and phasing out the old. . . . Of course the process must not be too slow."

What Budget Provides

The $34.6 billion Fiscal 1957 defense budget signed by the President last week provides the services:

- **Air Force, $16.4 billion** (This compares with $14.7 billion for Fiscal 1957. The first "flash" estimate of Gen. Twining is that $23.6 billion will be the Fiscal 1958 requirement).
- **Navy, $10 billion** as compared with $9.1 billion for Fiscal 1957. First estimate for Fiscal 1958: $13 billion.
- **Army, $7.5 billion** as compared with $7.3 billion for Fiscal 1957. Army's first estimate for Fiscal 1958 is $12 billion.

The first estimates of the services for Fiscal 1958 add up to $48.6 billion. This is over $10 billion above the $35 billion top-water mark that Congress has informally set for defense appropriations. The outlook is for stiff service rivalry when decisions are made as to where the cuts must fall.

A substantial part of the Symington subcommittee sessions were spent in Democratic efforts to develop the thesis that economy has dominated defense decisions, and that Wilson consistently delayed in ordering an increased B-52 production.

Sen. Jackson protested that Wilson waited from May, 1955—when Russia first demonstrated Bison jet bombers in production numbers—to April of this year before increasing B-52 production from a planned 17 a month to 20 a month. Jackson was also critical of Wilson's statement of February, 1954, that Russia was building "defensive" airpower.

"If they had production numbers in May, 1955, they certainly must have been building them in February, 1954," Jackson declared.

Wilson replied that his statement had not meant that Russia was building "only" defensive power. In 1954, he said, the Defense Department knew only that Russia had one Bison, but that "to play it safe" had opened a second source of B-52 production at The Boeing Airplane Co. plant at Wichita and increased target output from seven to 13 a month.

Army May Buy European Aircraft, Engines

By Claude Witze

Washington—Small quantities of carefully selected European aircraft, engines and equipment may be purchased for suitability tests by the U. S. Army before the end of Fiscal 1957.

No final decision has been made to proceed with the program, and, if it is undertaken, it will be for the initial purpose of evaluating foreign work in the selected areas.

These areas include STOL and VTOL aircraft, helicopters, landing gears and small turbine engines. The Army believes purchase and evaluation of sample quantities of these products may bring a high return, at least in the form of support to technological development in such countries as France, the United Kingdom and Western Germany.

"If we can find something hot running along at slow poke speed," an Army officer told AVIATION WEEK, "we would be derelict to exclude it from consideration in our planning for the future."

Within the past few weeks, a team representing Army research and development has toured European military ground force installations and aircraft industries in search of ideas and hardware that can be applied to Army problems.

At the same time, steps are being taken to activate a new Army Research and Development Liaison Group at Frankfurt, Germany. The unit, established on May 15, operates under Lt. Gen. James M. Gavin, Army research and development chief, and is staffed by three technical officers.

The mission of the Frankfurt office is to hire scientific and technical talent of Western Europe to do research work for the Army. Aeronautics, as well as other sciences, will be included.

Europe's Skills

The Army says contracts will be negotiated with selected European universities, research institutes and industries for performance of basic research.

The projected purchase of certain European aircraft and engines, on the other hand, indicates a growing interest in technological development. It applies to items perfected by foreign manufacturers with their own money or, in the case of government-owned factories, with support of public funds.

There is a conviction in some Army circles that Europe's traditional leadership in many aeronautical specialties is coming to the forefront with the advancement in the state of the art. In particular, Europe's engineers have been under compulsion to develop aircraft that do not need immense airports. In most cases, these are small aircraft with superior performance. Perfection of the small turbine engine has been a parallel development.

A Department of Defense committee, representing the office of Dr. Clifford C. Furnas, assistant secretary of defense for research and development, also has studied European aviation advances and, in some instances, toured foreign plants with the Army group. The Department of Defense approach is based upon the fact that possibly 50% of the aeronautical research and development under way today is being conducted in Europe. Under these circumstances, no study of the state of the art can ignore foreign developments.

French Developments

Further evidence of this was the establishment in August, 1952, of a European office by USAF's Air Research and Development Command at Brussels. It is headed by Brig. Gen. Don Flickinger. In some cases, it is possible that ARDC's unit will be competing with the Army Liaison Group at Frankfurt.

On its tour of European facilities, the Army team showed special interest in French developments indicating that the French army, like its U. S. counterpart, is moving toward tough, rugged aerial transport vehicles. French interest in this type of army aviation is being stimulated today by combat experience in Algeria, where they are fighting a "brush" type war in tough terrain.

In these battles, short-takeoff-and-landing aircraft with substantial payload capability would be a tremendous asset.

So would transport helicopters capable of carrying a heavy load and also impervious to the heat and destructive sand blasts of the North African desert.

French aircraft studied by the Army team included the Breguet STOL transport, the Djinn turbine cold pressure cycle helicopter and light-weight fighters designed for NATO, including the Dassault. Also demonstrated was a skid landing gear installed on a high-performance fighter.

German Progress

In Germany, the group was favorably impressed by the Dornier DO 27 transport, a STOL aircraft utilizing advanced slot and flap installations. Stability and control were described as excellent.

The German Helicopter Society, it was learned, has studied both U. S. and British developments since World War II and is not impressed. The society is laying down the ground rules for a satisfactory rotary-wing aircraft of its own and soon will offer prizes for design of a simple, low-cost vehicle. Improved helicopter rotor systems are one of the major interests of German inventors.

On their tour of British plants, the Army group became familiar with Fairey Aviation's helicopter efforts. These include a compound helicopter, the Rotodyne and a light two-place machine, both driven by tip burners.

Napier Family

The Napier family of gas turbines, the Eland, Oryx and Gazelle, are all of low horsepower and suitable for helicopter use. They seem to be strong contenders for consideration by the U. S. Army.

Scottish Aviation demonstrated both the twin-engine and single-engine Pioneer transports at Prestwick. STOL performance of the Pioneer was described by Army witnesses as "tremendous."

With a two-ton payload, the twin-engine machine can land and takeoff with not more than 300 yards of runway.

Special emphasis is placed on British advances in the field of jet tip-propelled helicopters. "There is a lot of activity in this field," one officer said, "and it is an important one to us when we are considering heavy loads over short distances with minimum maintenance costs."

Mutual Support

In addition to a survey of existing equipment, the Army tour provided a discussion with European military and industry leaders of U. S. and foreign army requirements. A basis was established for the exchange of information and future mutual support, through common contracts and the Mutual Weapons Development project.

Army observers say that, with few exceptions, all European manufacturers recognized that any equipment found suitable for U. S. Army use would have to be manufactured in this country through license agreement with an American aircraft firm.

As for U. S. industry, the Army feels that the most progressive firms are objective about the new approach to Europe.

Like the Army, many of them are eager to exploit advances made in other countries if these will be helpful to the Army program.

Army to Open Contract Proposals For Primary Helicopter Training

Washington—The U. S. Army next week will open proposals from training school operators seeking a contract to conduct the primary cargo helicopter pilot course at Wolters AFB, Mineral Wells, Tex.

Target date for the start of classes at Wolters is Jan. 7, 1957. The base was officially transferred from USAF to Army jurisdiction on July 1.

First steps towards the start of contracted primary fixed-wing pilot training at Gary AFB, San Marcos, Tex., will be taken this month when requests for proposals are sent out by Air Materiel Command headquarters. The Air Force, in this case, is acting as procurement agency for the Army, which will get responsibility for the contract after it has been awarded.

Training at Gary also will begin in January. Transfer of the base to Army jurisdiction is expected on or before Jan. 1. Unlike Wolters, which will be a military installation, Gary will be a contractor operated base.

Successful bidder on the Wolters contract to train cargo helicopter pilots will provide flight and ground school instruction along with maintenance of the necessary aircraft. The helicopters will be provided by the Army. The course of instruction will run 18 weeks at Wolters, followed by 12 weeks of advanced work at Ft. Rucker, Ala., the Army's Aviation School. Students will be enlisted men, who will become warrant officers upon completion of training.

The military population at Wolters will include about 75 helicopter preflight students, 200 helicopter pilot students and about 360 in the civilian training force. New classes will start every four weeks.

At Gary, primary fixed-wing training will be given to officer candidates. There will be about 500 of them in attendance at all times, with a regular 45-man military detachment on duty. The civilian contractor, in this case, will have about 700 employes on the base.

Army aviation tactical fixed wing and advanced cargo helicopter pilot training will be continued at the Ft. Rucker school.

India Orders Mystere 4A

New Delhi—India will buy French Mystere fighters. Sources in Paris identified the model as the Dassault Mystere 4A and the contract number as 100. In New Delhi, where the agreement was reported after the return from France of Indian Defense Secretary M. K. Vellodi, the quantity was reported as 110.

Deliveries are to begin by the end of the year. The Mystere 4A is built by Dassault and two state companies, Sud-Ouest and Sud-Est, with final assembly at the Dassault Merignac plant.

India also is considering the Canberra bomber for its purchase program. In a projected visit to Britain, the defense secretary in addition will conclude the details of an Indo-British agreement for production of the Folland Gnat at the government-owned Hindustan Aircraft, Ltd., Bangalore (South India).

News Digest

USAF bases in Spain will receive 27 Superior diesel engine power generating units. The manufacturer, White Diesel Engine Division, Springfield, Ohio, earlier this year received a Spanish order for 15 units for pumping jet and diesel fuel through pipe lines.

Airlift of two million lb. of equipment from Long Island to Caribbean area, begun last month by Air Force reserve troop carrier aircraft from 12 of the 13 wings, will be biggest airlift in reserve history. Cargo, carried in C-46 and C-119 aircraft, is for Coast Guard Loran chain. Lift will continue into September.

Air Force Operational Test Center Eglin AFB, has tests under way on F-89H Scorpion, the F-102, the F-100D, the B-66, the C-130 and the KB-50 aerial tanker. In recent tests, three F-100s from Tactical Air Command successfully refueled at the same time from single tanker. Marine helicopter, Sikorsky HR2S-1, is being tested by Navy detachment in the Air Force Operational Test Center climatic hangar.

Advanced helicopter hovering detector, designated AN/APN-97 (XN-2) will be built by Ryan Aeronautical Co. under Navy contract. Device, to prevent drift from hovering location, is an outgrowth of Ryan AN/APN-67 automatic navigator, in production for Navy.

Additional shares will be offered to Marquardt Aircraft Co., stockholders about July 18. Shares not subscribed in allowable period, expected to be 20 days, will be bought at subscription price by Olin Mathieson Chemical Corp., and Laurence S. Rockefeller, company's two principal stockholders.

Chrysler Corp. has received a $3,175,000 Army contract for engineering and production work on the Jupiter intermediate-range guided missile. Chrysler also will continue production of the Redstone, Jupiter's predecessor.

French air force has ordered experimental group of ten Sud-Ouest Trident light supersonic interceptors.

Earnings of $3 a share for the first nine months of this fiscal year on gross sales of $56 million are estimated by Beech Aircraft Co. Earnings of $1.35 for third quarter compared with 91 cents a share for previous quarter, backlog is more than $93 million, compared with $84 million as of last March. Directors declared 30 cents quarterly dividend payable July 27.

Napier Eland N.El.1 single-spool turboprop engine has passed Ministry of Supply 150-hr. type test at rating of 3,060 ehp.

Backlog of aircraft orders on hand but undelivered is about $15 billion, compared to $13.5 last January, Commerce Department reports. Department's mid-year survey calls for continued high level operations in most areas of economy for last half of year.

Rolls-Royce Tyne turboprop flight testing is under way at firm's flight development establishment at Hucknall. Tyne, chosen to power Vickers Vanguard (AW June 18, p. 43), will fly in Avro Lincoln flying test bed. Rolls-Royce Avon will be powerplant of English Electric P. 1 supersonic fighter.

Lay-off of 500 workers by Avro Aircraft Ltd., Toronto, is ordered to stretch out production of subsonic CF-100 twin-jet interceptor until production of CF-105 begins. Orenda PS-13 Iroquois jet engine, which will power CF-105, has passed 50-hr. preflight rating test.

Hawker Siddeley Nuclear Power Company permanent headquarters have been established on Hawker Aircraft Co. premises at Langley Airfield, Bucks, England.

Thai Airways order for three Super-G Constellations at a cost of more than $6 million calls for delivery in 1957.

Air Force contract of $188,250,000 with Ford Motor Co. Aircraft Engine Division at Chicago for additional J57 turbojet engines increases division total of orders and deliveries to more than $1 billion.

Combat commuter –

at 8 second intervals

In recent tests duplicating actual assault landings, Fairchild C-123's gave dramatic evidence of performance under combat conditions.

The target—a rough, ungraded field—was ringed by "hostile" forces. Heavily laden, the C-123's approached the field at 500 ft. altitude—too low for heavy A.A. guns, too high for small-arms fire. Just short of their touchdown point, the highly maneuverable assault transports swept down, flaring out just as they flashed over the clearing's edge. Two minutes later, twelve C-123's had rolled to a halt—troops and trucks were fanning out to their assigned positions. The C-123's had landed at *8 second intervals!*

This dramatic demonstration of pilot and crew proficiency was made possible by C-123 maneuverability, short field performance and utter reliability—all three, features of Fairchild aircraft designs.

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...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

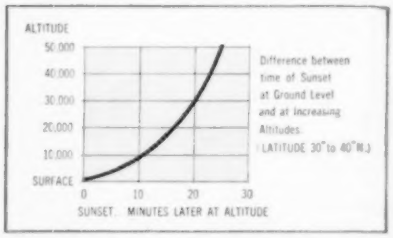
FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

NIGHT FLYING

ON NIGHT FLIGHTS you may have to fly on instruments in haze or smoke condition, due to loss of horizon. It's also hard to judge distance from clouds, and you may find yourself in them. Keep in mind that fog is more common at night than in daytime. And on clear nights over desert areas near mountain ranges, strong Katabatic winds (cool air sliding down mountain slopes) can reach gale strength. This can make it difficult to hold altitude with available power.

However, as a rule, air becomes smoother after sunset, as vertical currents tend to subside. This is especially true in lower levels.



Remember — when it's twilight at 6000 ft. it is already dark on the ground, due to curvature of the earth. Graph above illustrates this. To land before dark, determine sunset time and plan flight accordingly.

Watch ground lights at night for signs of fog. This is indicated by lights appearing fuzzy or indistinct.

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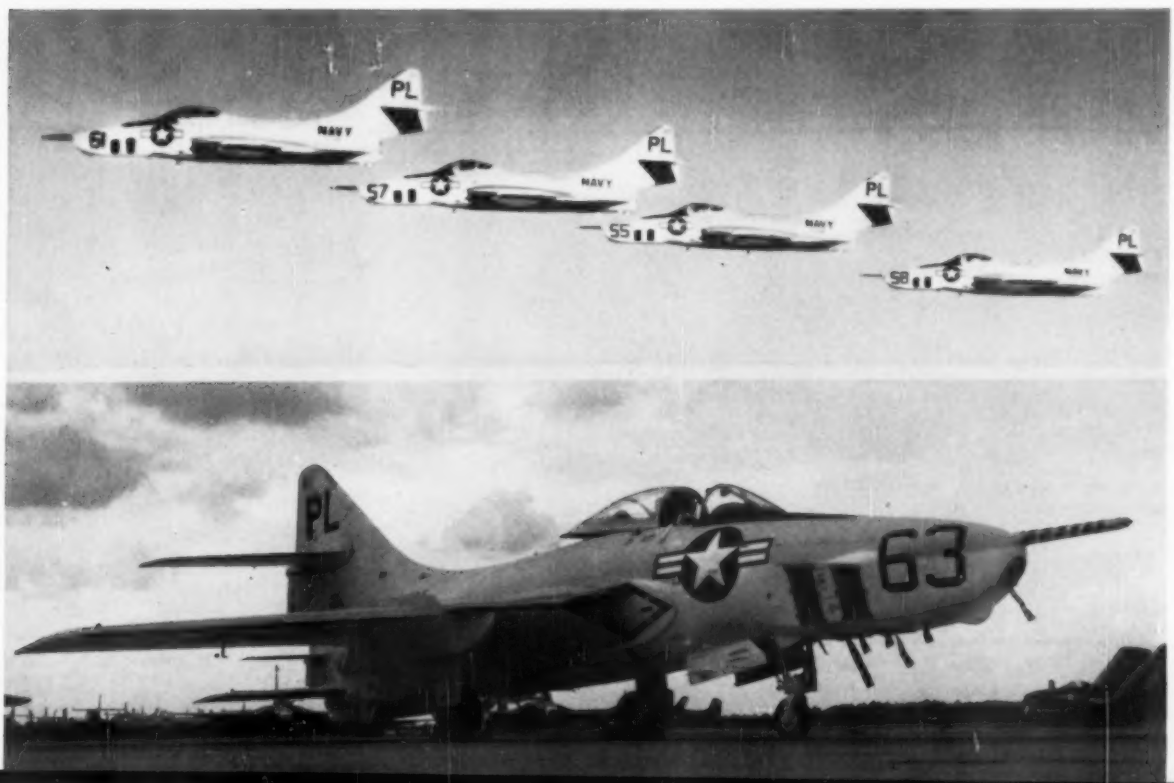
three, features of Fairchild aircraft designs.

Cougars in Flight Show Modifications

Underside bulge on noses of F9F-8Ps (below) distinguish photo-reconnaissance version of Navy fighter from F9F-8 (above). Both versions have nose probe for refueling. Top picture clearly shows cambered leading edge extensions on wing which distinguish F9F-8 from earlier Cougars. Trailing edges also are extended, adding 15% to wing chord and making relatively thinner wing for transonic flight. Wing fillet also is longer than earlier versions. Photo plane formation, with operational markings, are from VC-62. Two seat model—F9F-8T—is in production for use as transonic trainer by Navy.



Airlines Draft No-Show Penalty Program

Two-step ticket confirmation plan provides for no-show fines of 20% of fare; liquor code adopted.

By Craig Lewis

Washington—The airlines have worked out a two-step ticket confirmation and penalty plan with which they hope to solve the no-show problem that has plagued them for years.

Under the new plan, airline passengers will have definite time limits within which they will have to pick up their tickets or lose their reservations. A set of penalties has been established for the late cancellations and no-shows which have grown to a level of 16% of total passenger boardings.

In separate action, the airlines also adopted a code to govern the serving of alcoholic beverages on all flights between points in the continental United States.

Ticket Deadlines

The no-show plan is scheduled to go into effect in two steps. The first phase, involving time limits for buying tickets, is to become effective on Sept. 16. Phase two, which involves the penalties, is scheduled to begin February 1. The plan must be submitted for Civil Aeronautics Board approval before it becomes effective.

The first part of the plan is designed to make the airline passenger definitely commit himself to his reservation by purchasing his ticket. Under the new rules, a passenger will have to pick up his ticket before the deadline (each airline will set its own) or his reservation will be canceled.

The carriers are free to establish their own local deadlines, but the plan sets minimum limits. On a reservation made before noon on the last normal business day before the date of departure, a passenger will have to pick up his ticket not later than 12:01 a.m. on the day of departure or six hours before departure, whichever is earlier.

ATC Recommendation

The passenger making a reservation after noon on the day before departure will be encouraged to pick up his ticket as soon as possible, but no time limit is applied in this case.

Establishment of a time-limit system raises questions of customer convenience and competitive advantage, and the Air Traffic Conference has suggested a number of solutions designed to make picking a ticket up more convenient and to help airlines without downtown ticket offices.

In many cities, city ticket offices, airport ticket facilities and travel agents are convenient enough. Where these facilities are not available, ATC suggests that the airlines could establish a central ticket pickup point. Another recommendation is that passengers be encouraged to pay for their tickets by mail or telegraphic money order.

An exception has been made to the deadline rule which will primarily help local-service passengers. Where time bars use of the mail, and the cost of a telegraphic money order exceeds $2 or 10% of the ticket price, the time limit will not apply.

The time-limit portion of the plan is being introduced first so that its effect can be studied and any necessary adjustments made before the penalties go into effect. Some airline officials feel the ticket deadlines may be sufficient to solve the problem and that it may not be necessary to institute a penalty rule, which is bound to be unpopular with the public.

The second phase of the program applies economic penalties to the passenger who cancels his reservation close to flight time or the passenger who simply fails to show up.

Penalty Charges

When a passenger cancels his reservation within six hours of departure, he will be charged 10% of the fare for the first leg of the flight. The service charge for late cancellations cannot be less than $1 nor more than $3.

The passenger who fails to show up for his flight—the no-show—will be charged a penalty of 20% of the fare for the first segment of the flight. The minimum penalty is $3, and the maximum is $20.

The service charge for late cancellation will not be applied when a passenger uses an earlier flight or takes a later departure which gets him to his destination before he would have arrived on the original reservation.

No penalty will be assessed for a passenger who buys his ticket after noon on the day before departure. This exception was made to avoid discrimination, since there is no deadline for picking up tickets on reservations made after that time.

The plan the Air Traffic Conference worked out and adopted last month is the culmination of over a year of study and argument. The recent efforts to solve the no-show problem were started after the conference's split decision to abolish the controversial reconfirmation rule on June 1, 1955.

CAB Threat

Since then, a number of plans have been proposed and discarded. When the ATC met in Washington last month to make another attempt, it was working under the threat of a CAB no-show investigation. The Board has been contemplating such an investigation for several months, and Chairman James R. Durfee let the ATC know the Board would step in if no agreement was reached at the meeting in June. (AW June 18, p. 25).

While the various plans for solving the no-show and multiple reservations problems were under discussion, some of the airlines returned to reconfirmation. Ten of the ATC member airlines

Breakfast in Style

Pretty stewardess Beverly Noe offers "hunt breakfast" to passengers on "Californian" flights of Western Airlines. Presented in copper chafing dish, it features breakfast steaks, broiled chops, ham slices, sausages and a selection of Danish pastries. Carts are foldaways mounted on rubber-tired wheels fabricated in WAL's own shops. Locked-on chafing dishes are finished in burnished copper. Passengers are served a breakfast tray of coffee, fruit and eggs, then select from copper tray. Western says most popular items are steaks, with Danish pastries a close second.

currently have reconfirmation in whole or part, and they probably will retain it while the new plan is being tried out.

When he announced the No-Show Control Plan, ATC President Arthur F. Kelly, a vice president of Western Airlines, said "the operation of the plan will be subjected to continuous study and periodic review. The public's reaction, when the plan goes into use, will be solicited."

Liquor Plan

Another problem the airlines have acted upon is the recent furor over serving liquor to passengers. Objections have been raised by some private groups and by airline employe groups, and the carriers are threatened with congressional action.

Airlines which serve alcoholic beverages on their flights have agreed upon a code covering the use of distilled spirits. Wine and beer are not included.

Under the code, the airlines agree not to serve more than two drinks to any one passenger, and the drinks will not contain more than 1.6 ounces of any alcoholic beverage. The carriers say they will not promote the availability of liquor or encourage drinking by their passengers. They also intend to continue their policy of refusing liquor to any passenger who, because of pre-flight drinking, might become objectionable to other passengers.

The agreement will stay in force indefinitely, although any airline can withdraw on six months' notice. American Airlines, United Air Lines, Trans World Airlines, Eastern Air Lines, National Airlines and Northwest Airlines are the carriers which serve distilled spirits and are covered by the agreements. Western Airlines serves champagne on some of its flights, but wine isn't covered by the code.

New C-46 Modification Deadline Set by CAB

Final deadlines for modification of C-46 transports to qualify them for passenger service have been set by the Civil Aeronautics Board.

Carriers using C-46s will have to complete modification and have the aircraft recertificated by Jan. 1, 1957. In order to continue operating them in passenger service until the deadline, C-46 operators are required to show a firm contract for the modification work by July 15, 1956.

The C-46 modifications were first ordered two years ago, but actual work has been delayed until type certificates were issued for the required changes. Two certificates were issued recently, and an application for a third certificate has been received.

Apparent United-TWA Collision Highlights Traffic-Control Problem

The apparent collision of Trans World Airlines and United Air Lines transports over the Grand Canyon on June 30 brought the nation's air-traffic-control problems into sudden and dramatic prominence.

This worst of all civil aviation disasters raised a substantial clamor for a solution to the air-traffic problem, and the tragic accident lends considerable strength to campaigns to bring air traffic control up to date and prepare it for the coming jet era.

The accident occurred when TWA and United flights eastbound from Los Angeles crashed about a mile apart in an isolated area of the Grand Canyon. All 128 people on the two planes were killed.

Preliminary investigation of the accident indicates that the two aircraft collided at 21,000 feet and then crashed into the canyon.

Flight Plans

The TWA airplane was Flight 2, a first-class Super Constellation flight bound for Kansas City, St. Louis and Washington. It carried 64 passengers and a crew of six. The flight departed Los Angeles at 9:01 A.M. with a proposed flight plan calling for the aircraft to fly to Kansas City at 19,000 ft. via Daggett, Calif., Trinidad, Colo., and Dodge City, Kansas.

The United flight was first-class DC-7 Flight 718 bound nonstop to Chicago, then on to Detroit, Philadelphia and Newark. It carried 53 passengers plus a crew of five. Flight 718's instrument flight plan was to climb to 21,000 ft. and proceed to Chicago via Palm Springs and Needles, Calif.; Painted Desert, Ariz.; Durango and Pueblo, Colo.

The United flight departed Los Angeles at 9:04 A.M. and was assigned an altitude of 21,000 ft. The flight checked in at Needles at 9:58 flying at 21,000 ft.

Before reaching its check point at Daggett, the TWA flight asked to climb to 21,000 ft. to avoid turbulence. Air Route Traffic Control refused the request, advising the pilot that there was a United Flight at 21,000. The TWA pilot then asked for clearance to climb to 1,000 ft. on top of the clouds, and this clearance was granted.

The TWA flight reported in at 20,000 ft. over Daggett and still climbing at 9:34.

Later, the flight reported over Lake Mojave at 21,000 ft., 1,000 ft. above the clouds.

When the TWA flight was cleared to fly 1,000 on top, it still was technically on instrument rules, but since the altitude was flexible, it amounted to operating under visual flight rules.

According to their flight plans, the two flights entered uncontrolled airspace about the time they crossed the Colorado River. At that time, the TWA flight probably was about 50 miles north of the United DC-7.

Although the TWA pilot was informed that the United flight was in the area at 21,000 ft., there is no record that the United pilot was informed of the location of the TWA flight.

When the two flights crashed, they had been operating on off-airway direct route flight in uncontrolled airspace for 130 miles. A flight operating in uncontrolled airspace gets an advisory service from traffic control, but it is largely flying on the see-and-be-seen principle of visual flight rules.

Both flights were scheduled to report again when they crossed a line between Bryce Canyon and Winslow radio points. When they failed to report, a search was begun.

The TWA Super Constellation crashed near the bottom of the canyon and can be reached by helicopter during certain hours when the air currents are calm. The United DC-7 struck higher up the canyon wall and is nearly impossible to reach.

Weather Factor

Weather may have been a factor in the accident, and government investigators were attempting to find reliable pilot reports of weather in the area at the time of the crash. A change in the weather could have changed altimeter settings as much as 1,000 ft. Since they were in uncontrolled airspace, the flights would not necessarily have reported a switch to instrument operation in bad weather.

Both the CAB and the Civil Aeronautics Administration have sent top-level teams to investigate the crash. William K. Andrews, Chief of the CAB Bureau of Safety Investigation, is directing the investigation with Leon Tanguay, Chief of the Bureau's Technical Division, supervising the investigation at the accident area. Also assigned to the investigation are W. Dickson Markey, of the CAB's Washington office; Leon Cuddeback and Earl Mitchell, of the Oakland office; George Haskins, of the Santa Monica office, and R. P. Parshall, of the Kansas City office.

Deputy Administrator James Pyle heads a CAA group which includes

W. B. Masden, W. B. Davis and D. D. Thomas.

The Grand Canyon crash produced considerable criticism and demands for action in both houses of Congress. The House Interstate and Foreign Commerce Committee decided last week to launch a comprehensive review of airspace use problems with an investigation of the TWA-United accident.

A subcommittee has been set up under Rep. Oren Harris (D.-Ark.) to conduct the probe. Rep. Percy Priest (D.-Tenn.), chairman of the Commerce Committee, said that the study would explore the committee's legislative responsibility in handling air traffic.

Sen. George Smathers (D.-Fla.) wrote Sen. Warren Magnuson (D.-Wash.), chairman of the Senate Commerce Committee, asking that the group investigate the CAA to determine whether the agency's operations are staying abreast of the growth in air traffic.

An overall review of air traffic problems by a subcommittee of the House Government Operations Committee already was under way before the TWA-United accident. Testifying before that group, Clarence Saven, president of the Air Line Pilots Assn., said the see-and-be-seen principle is obsolete. Saven said airline pilots agree unanimously that they are "operating under a rule that is incapable of performance."

Saven also pointed out that altimeters are often inaccurate at the higher altitudes, and that a new type of instrument must be developed.

In other action, Sen. Hubert Humphrey (D.-Minn.), said it is time Congress took action on air accidents. He said that the CAB and CAA should order the airlines to take every conceivable safety precaution.

Sen. Spessard L. Holland (D.-Fla.) observed that the CAA already is taking steps to improve air traffic control with a new $246 million five-year program. Congress appropriated $40 million to start the program this year.

When the CAA obtains the facilities scheduled under the five-year plan, it will have better surveillance of areas like the one in which the two transports crashed since such areas will be covered with long-range radar.

The CAA recently raised the status of its air-traffic-control operations when it created a new Office of Air Traffic Control under David Thomas.

The Air Transport Assn. is currently promoting the development of a proximity indicator which would be used to warn a pilot when another aircraft is within a certain radius of his airplane.

The ATA reached no decision on a proximity warning indicator at its recent board of directors meeting, but it did set up a committee to discuss the project with the electronics industry and report at the next board meeting.

Shutdown or Revise ANDB, Arnold Tells Subcommittee

By L. L. Doty

Washington—Milton W. Arnold, vice president of the Air Transport Association, urged last week that the Air Navigation Development Board be either abolished or completely reorganized. The present ANDB, Arnold said, is "dead" and awaits only a "formal funeral."

Testifying before the House Government Operating Subcommittee, Arnold also made these pointed comments:

- **Called for the elimination** of the Technical Development Center of the Civil Aeronautics Board administration.
- **Charged the CAA** with a lack of forward thinking and planning.
- **Accused government agencies** of sitting in sole judgment on air-space allocations.
- **Criticized the Airport** Use Panel's "closed-door policy" which, he said, has usurped the rights of civil operators.

ANDB 'Deadlock'

Arnold praised the ANDB staff for their "integrity, devotion and abilities" and attributed the Board's deficiences to poor organization. Under its present structure, he said, the ANDB can make no decision unless there is complete agreement between the voting members and the Departments of Commerce and Defense. His recommendation for breaking this deadlock, if the ANDB remains intact, was the addition of a third member to be appointed by the President and confirmed by the Senate.

He urged, however, that the ANDB be dropped and that its responsibilities be absorbed by Edward Curtis, special presidential assistant for aviation facilities planning. Such a step, he added, would prevent the "complete lack of decision we are now experiencing with the ANDB."

CAA Lag

Arnold reacted unfavorably towards proposed legislation which would establish a 16-member commission to seek a solution to current airway problems. He compared the suggested measure with the Hoover Commission which, he said, created "reams of paper but very little improvement" in governmental organization.

There is nothing wrong with the basic concept of the CAA and its legal function in the control of traffic, Arnold said. He added, however, that the CAA program for the development of electronics and navigational devices is "geared by funds and facilities to the requirements of aviation in 1938."

He called the CAA five-year-plan for traffic control a "patchwork" approach and accused the Technical Development Center of being "approximately 10 to 15 years behind in money, facilities and staffing."

Arnold said application of known techniques can bring about an improved traffic-control system without increasing the complement of control personnel. Such a move, he added, requires "dynamic leadership supported by adequate budget allowances." His suggestions for safe separation and control of aircraft included:

'Safe' Traffic Control

- **A new method** of semi-automatic visual communication between the pilot and controller to reduce voice communications.
- **A method involving** an "electronic reservoir of data" such as aircraft speed, position, altitude and direction which can be automatically displayed before the controller.
- **Expansion of radar** facilities.
- **Airport flashing discharge lights.**
- **High-intensity** approach lights.

To clarify what he termed the Airport Use Panel's "closed-door policy," Arnold told the subcommittee that the airline industry was interested in all but two of 22 cases pending before the panel as of Jan. 1, 1956, but was asked to consult with the panel in only four of the cases. "Exclusion of civil users from such discussions," he said, "cannot be tolerated."

Tacan Dispute

The Tacan-VOR/DME issue is controversial, Arnold said, because there is no final judge to decide on the merits of each system. If the military proves their stated need for Tacan, he continued, the airline industry has no choice but to accept it. On the other hand, Arnold said VOR/DME is preferred by the airlines because it is less expensive and lead time is considerably shorter.

During the hearings, Arnold was asked if he could attribute the recent accident involving Trans World Airlines and United Airlines to an inadequate airway traffic-control system. Arnold withheld any comment, saying no determination of cause can be made until all the facts are known.

Arnold did say, however, that airborne radar provided no solution to

anti-collision problem. Tests with both radar and television, he said, have proved inadequate because of the three-dimensional factor in airway traffic control.

Arnold said the excess air space required for each aircraft on today's airways is an outgrowth of communication lags and lack of up-to-date aircraft-position information. He described voice radio as "a party line system where a pilot must listen to all calls to be sure he will recognize those intended for him. We haven't even added the hand-cranked Bell telephone of 1900, let alone either a local or long-distance dial system."

Capital Gives Viscount Expenses, Load Factor

Washington—The break-even load factor of Capital Airlines Viscount transports is less than the average for the company's piston-engined aircraft. Operating costs of the new aircraft are only slightly above original estimates.

Total mileage costs of the Viscount were reported at $1.57 per mile as compared with an original estimate of $1.54. The break-even load factor was set at 56.8%. Capital President J. H. Carmichael said depreciation expense will decline seven cents per mile when the Viscount fleet is in full service, and the utilization rate reaches eight and one-half hours. This will reduce costs to 71 cents per mile for a total cost of $1.50, Carmichael said. Utilization as of May 30, 1956, was six and one-half hours.

Direct operating costs were reported at 78.2 cents per mile, while indirect costs were reported at 79.2 cents per mile.

Carmichael reported the Viscount's average speed at 249.4 miles per hour as compared with an originally-estimated speed of 239 mph.

The airline president also forecast that the break-even load factor will level out at a point somewhere between 53% and 55% and that total costs "will be below the original estimate for a long period to come."

BEA Extends Helicopter Service Into Midlands

London—British European Airways last week began a twice daily service with Westland W.S. 55 helicopters connecting Birmingham with Leicester and Nottingham, provincial cities in the Midlands.

They are the first two English provincial cities to have direct intercity helicopter service.

In Birmingham, the service connects with Viscount and Elizabethan flights to London and the continent.

American, United Offer ALPA Candidates in Move to Oust Sayen

Washington—The move to oust Clarence Sayen as president of the Air Lines Pilots Association gained force last week as pilots of two major airlines took steps to nominate their own candidates for the union's top office.

If the two groups are successful in presenting their nominees before the November convention, it will be the first time that Sayen's position has been contested during his five years of office. Conventions are called biennally and officers are elected for two years.

In a resolution passed by American Airlines pilots, Captain W. H. Drummond was proposed as a candidate. Drummond has been an American pilot for 16 years and has been active in ALPA affairs for the last 10 years.

Support for Sayen

Pilots of United Airlines have appointed a committee to recommend a United nominee for the office. The two moves do not necessarily imply that pilots of other airlines will follow suit and pick candidates from their own ranks.

Sayen is not without his supporters. Pilots of several airlines have voiced satisfaction with Sayen and the manner in which he has represented them. One pilot expressed himself this way: "Airline piloting is a profession and Sayen has governed ALPA in a highly professional manner."

It is difficult to pin-point the major source of contention among pilots seeking to depose Sayen. One complaint was registered against the system of refunding over-payments of dues. Another objection was failure to consult pilots on major issues.

American Resolution

The American Airlines resolution noted that "there are signs of some unrest" and that there "seems to be a desire for changes in the organization."

Sayen, a former Braniff Airways pilot, was elected president of ALPA in July 1951, succeeding the late David Behncke. Behncke was ousted from the post shortly after he had fired Sayen as ALPA executive vice president. A stormy year for ALPA followed Sayen's appointment as Behncke took legal action to reclaim the title lost to Sayen. Behncke was founder of the union and served as its head for some

N. Y. Starts Heliport Construction

Long-delayed construction of Manhattan's first commercial heliport was begun last week by the Port of New York Authority after final agreement with city-fixed rent of West 30th Street site at $14,323.60 for first year, increasing to $71,618 for fifth year. The $320,000 experimental facility will be completed in September. New York Airways will use it first for mail and cargo and later for passenger helicopter service.

Over a million airline hours of turbo-prop Viscount experience will be built into the Viscount 810-840.

the new 400 mph turbo-prop

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designed for greater profits and economy

The Viscount 810 • 840 is designed to cruise up to 400 miles an hour at 20,000 feet. Carrying up to 70 passengers, it will be the ideal aircraft for medium-haul, high-density routes. Higher speed and enlarged capacity are combined with greater engine economy and relatively low first cost to give the Viscount 810 • 840 its unique advantages. Powered by four new Rolls-Royce Dart R. Da. 7 or R. Da. 8 turbo-prop engines, the new Vickers Viscount 810 • 840 will be put into service by Continental Airlines in 1958. By then Vickers Viscount aircraft will have amassed more than a million hours of flying experience.

Behind the new Viscount 810 • 840 stands the great name of the Vickers Group—internationally famous as makers of aircraft, ships, industrial machinery and precision equipment.

United States Representative: Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N. Y.

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twenty years until objections to his "one-man show" resulted in his expulsion.

In July 1952, Behncke won a final decree issued by a Chicago U. S. District Court naming him legal president of ALPA. Behncke promptly announced that all contracts negotiated under Sayen were illegal and that no pilot could negotiate with airline management without the approval of Behncke.

Sayen, with the support of 90% of the pilots of eight trunk and international airlines, organized a separate union, the Air Transport Pilots Association.

At the same time, he asked the U. S. Circuit Court of Appeals for a stay of the order granted Behncke.

The stay was granted in November 1952, and Sayen was re-elected president of ALPA in the same month.

CAB Gives Mackey New Havana Route

Washington—A five-year renewal of Mackey Airlines' operating authority and expansion of the airline's route system to Havana and new points in the Bahamas has been granted by the Civil Aeronautics Board and approved by President Eisenhower.

The CAB added a new route between West Palm Beach-Palm Beach and Ft. Lauderdale, Havana and Nassau to Mackey's system and added the Biminis, Great Abaco and Eleuthera Island, British West Indies, as intermediate service points on the carrier's old route.

Mackey's three-year-old route between Tampa and St. Petersburg, Fla., and Nassau, B. W. I. via West Palm Beach-Palm Beach and Ft. Lauderdale was renewed for five years. The CAB said Mackey's service has been convenient and reliable.

It also noted that Mackey's operations have shown a continued growth and financial improvement and that its service has had no particular adverse effect on any other airline.

In renewing Mackey's authority, the Board rejected applications of National Airlines and Eastern Air Lines to take over the smaller carrier's routes. The CAB said that the greatest need is for the type of service Mackey offers, and that there isn't enough traffic for competitive service.

The CAB reversed its examiner in the Mackey case on the duration of the new authority. The examiner recommended a three year renewal, but the Board felt such a short period would fail to give the airline enough time to establish itself in its markets and decided to renew the certificate for five years.

CAB-Braniff Compromise Dispute; Airline Can Drop Minnesota Stop

Washington—The Civil Aeronautics Board last week decided to compromise with Braniff Airways in its dispute with the airline over continuation of service to certain points in North Dakota, South Dakota, Nebraska and Minnesota.

The CAB decided to make Braniff continue serving Mitchell and Yankton, S. D., and Norfolk, Neb., and to provide service between Sioux Falls, S. D., and Fargo, N. D., via Brookings and Watertown. The airline had planned to discontinue all these services. The Board decided, however, to allow Braniff to drop Worthington, Minn., from its route system.

At the same time, the Board began a new investigation to choose a local service airline to serve the points. Frontier Airlines, North Central Airlines and Ozark Air Lines have filed applications for various routes in the area, and the CAB's new expedited case will choose one to replace Braniff.

Braniff's authority to serve the points expired June 30. The CAB is requiring the airline to continue its service until 60 days after the Board picks a local service carrier to replace it.

A dispute between Braniff and the CAB arose last January when the airline told the Board if did not want its authority renewed when it expired June 30. The CAB then instituted an investigation to determine whether Braniff should be forced to continue its service until it was replaced.

The examiner in the investigation found that Braniff should be required to continue its service until sixty days after a decision is reached in the complex Seven States Area Investigation which is concerned with local airline service in the general area.

Braniff objected to this finding. The airline offered to continue its service if the CAB would carve out of the Seven States Case an expedited case limited to the issue of service to the Braniff points.

The CAB has decided to do this, although it makes it clear that it has the power to make Braniff continue to serve the points unwillingly until the Seven States Case is over.

The decision was reached on a three-two vote with CAB members Chan Gurney and Harmar D. Denny dissenting. Gurney and Denny feel that the CAB has "created another 'area case' which will undermine and defeat the primary purpose of the Seven States Area proceeding."

The dissenting members said the simple solution to the problem was to order Braniff to provide service until after the Seven States Case is decided. Starting a separate case complicates the situation and sets a dangerous precedent for future cases, according to Gurney and Denny. They feel that going ahead with a separate case dealing with Braniff's points is economically unsound and unfair to the carriers and the cities involved.

International Aviation Commission Proposed

Caracas, Venezuela—Creation of an international air navigation commission to deal with the urgent needs of civil aviation as it enters the jet age was proposed last week by the United States delegation to the International Civil Aviation Organization.

The proposal calls for establishment of a staff of experts provided by ICAO member states to work under a coordinator. The plan in many respects would parallel on an international scale the work now being done in the U. S. under the direction of a special aide to President Eisenhower, Edward C. Curtis. The task force would work in the field to solve the pressing problems of air navigation services and facilities.

The U. S. proposal has attracted great interest at the conference, which is being attended by 263 delegates representing 52 countries and eight international organizations. It is recognized by the ICAO members that present facilities fall short of satisfying even current operational requirements and they fear the possible consequences of the shortcomings. The situation, the delegates believe, will become still more serious as new higher-performance equipment is introduced into the crowded airspace. Since safety cannot be compromised, a workable solution is urgently needed and it is hoped that the task force plan may provide one.

Israel Complains Arabs Jam Air Communications

Tel-Aviv—Israel has complained to the International Civil Aviation Organization, meeting at Caracas, that Arab nations have been jamming ground-to-air communications of Israeli airports and refusing information to planes in distress bound for Lydda.

Israel also protested "obstructionist tactics" by the Arab nations, including the blocking of establishment of a regional Middle East flight information center.

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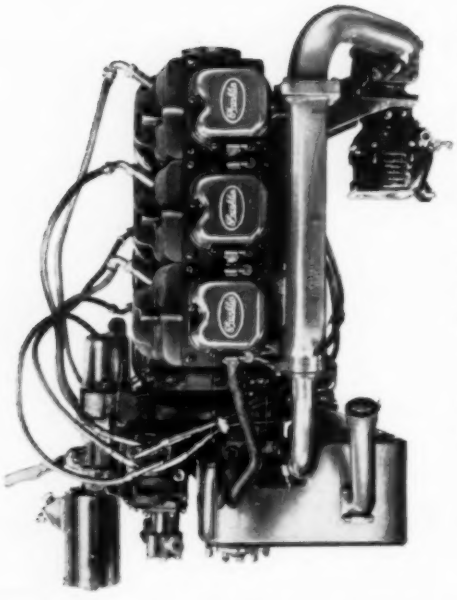

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IATA Fare Struggle Ignored By Loftleidir

Stockholm-Loftleidir Icelandic Airlines, aloof from the recent International Air Transport Assn. fare struggle at Cannes, continued even as the debate went on to carry transatlantic passengers at lower rates than the other scheduled carriers.

Not an IATA member, Loftleidir signed an air agreement with the U.S. before IATA was formed. On the New York-Revkjavik leg of its U. S.-Europe flights, the Icelandic carrier knocks $60 off the one-way IATA rate. Between Iceland and Europe the airline charges IATA rates as required by agreements with European countries.

Loftleidir operates three DC-4s over the North Atlantic, offering five flights weekly from New York during the summer season. It expects to carry about 4,700 passengers June through September, 1956.

Founded by three pilots, the airline started out with a Stinson, spotting herring for a fishing fleet. New York-Europe service was begun in 1948 with a single Skymaster.

Loftleidir has run into difficulties with the Swedish government over landing rights, and a new agreement is now under negotiation.

It is said to include the question of tariffs. Some IATA carriers in the past have strongly protested Loftleidir's fare policies.

In Iceland, where rugged terrain favors air transportation, air passengers last year equaled one-third of the population. Loftleidir has had further trouble with Icelandic Airways, the country's other carrier. Issue in the dispute was distribution of domestic routes. Result was concentration by Loftleidir on its international runs.

The reduced IATA fares are not regarded by Loftleidir as spelling an end to the DC-4 operation. Loftleidir believes it can continue to cut its rates proportionately.

Akron-Canton Airport To Introduce Belt Ramps

Mechanical rubber belt ramps to transport passengers are expected to go into service for the first time at any airport when Akron-Canton's new $1,368,000 terminal building is completed. Construction of the terminal is scheduled to begin some time next year.

Four moving ramps are to connect the building's two main floors. The electrically operated belts will be 44 in. wide.

The ramps will be 65 ft. long. Cost of the beltwalks reportedly will be about $300 a ft. as compared with about $1,300 a ft. for escalators to do the job.

Swissair's First Metropolitan

First Convair Metropolitan of Swissair's new fleet of 11 shown at N. Y. International Airport just before ferry flight to Zurich. Metropolitans are to be used on Swissair's medium-length routes in Europe. Seating 44 passengers in tourist configuration, the craft is fitted with weather-mapping radar equipment.

CAB ORDERS

(June 21-27)

GRANTED:

Purdue Aeronautics Corp. an exemption to perform a charter flight from Columbus, Ind., to Muskoka, Ontario, Canada, pursuant to an agreement with George Newlin.

United Air Lines an exemption to provide free transportation to technical representatives of Sperry Gyroscope Co. for in-flight observation and monitoring of Sperry Equipment on DC-7, DC-6B and DC-6A aircraft for a period of six months.

Southwest Airways authority to suspend service at Santa Cruz-Watsonville, Calif., until the carrier's temporary authority to serve the point expires on Dec. 28, 1958.

Southern Airways permission to serve Dothan, Ala., through Dothan Municipal Airport and to serve Panama City, Fla., through Fannin Field.

Permission to intervene in the Seven States Area Investigation to the Ashland, Wis., Chamber of Commerce; the City of Iowa City, Iowa; the City of Lincoln, Neb.; the Lincoln Chamber of Commerce, and the Lusk, Wyo., Chamber of Commerce.

Permission to intervene in the Great Lakes-Southeast Service Case to the City of Charleston, S. C., and the Charleston Chamber of Commerce; the City of Chattanooga, Tenn., and the Chattanooga Chamber of Commerce, and the West Palm Beach, Fla., Chamber of Commerce. Petitions of seven communities and organizations were denied.

Riddle Airlines an exemption to serve Norfolk, Va., on its route between Boston and Miami, for one year.

Seaboard and Western Airlines an exemption to off-load a baby elephant at Boston on a flight from London to New York.

APPROVED:

Agreements between certain members of the Independent Military Air Transport Assn. and the Air Coach Transport Assn. relating to tenders to the military agencies.

Control relationship between All-Airtransport, Inc., and Alltransport, Inc., and interlocking relationships between Hans E. Nachbur, R. O. Haller, A. H. Floch, All-Airtransport and Alltransport, with certain conditions.

Interlocking relationships between Sherman Fairchild, Pan American World Airways and the Fairchild Engine and Airplane Corp. until Sept 24, 1956, to allow further time for consideration, providing FEAC does not enter into discussions with Pan American concerning the sale or purchase of F-27 aircraft.

ORDERED:

Flying Tiger Line's authority to conduct 18 charter flights in July pursuant to a contract with the Intergovernmental Committee on European Migration amended to allow FTL to conduct 21 flights.

Lawrence Aircraft Service's authority to employ pilots in operating as an Alaskan Pilot-Owner extended until sixty days after decision in the Intra-Alaska Route investigation.

Pacific Western Airlines' application for transfer to it of the foreign air carrier permit of Queen Charlotte Airlines consolidated with the case involving QCA's permit renewal.

Investigation of Railway Express Agency to act as an international air freight forwarder and to handle air freight as an agent of certain direct air carriers.

DISMISSED:

Suspension and investigation of Trans Caribbean Airways' proposal to provide free ground transportation at origin point and to provide an additional free baggage allowance when passengers delivered baggage to the carrier 24 hours ahead of flight departure. The proposals have been canceled.

Delta Air Lines complaint against certain specific commodity rates proposed by Riddle Airlines, since the rates have been canceled.

Allegheny Airlines application for a route between Cincinnati and Detroit via Dayton, Lima and Toledo, at the request of the applicant.

Allegheny Airlines application for a route

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between Pittsburgh and Detroit via Wheeling, W. Va., and Zanesville, Mansfield and Toledo, Ohio, at the request of the applicant.

DENIED:

North Central Airlines' petition for a waiver of restrictions on security transactions for certain of its directors for the period July 31 to Sept. 14, 1954, a period when informal mail rates conferences involving North Central were held.

Shortlines

▶ **Braniff Airways** has ordered Bendix RDR-1 airborne weather radar for installation on its fleet of DC-7C aircraft. Delivery of Braniff's DC-7Cs is scheduled to begin in September. . . . Braniff's board of directors has voted a dividend of 15 cents per common share for stockholders of record as of July 5.

▶ **Calgary, Alberta, Canada,** has opened a new $1 million terminal at its municipal airport. The 1,400-acre airport has a new hydrant refueling system, and its runway pattern includes 8,600 and 6,400 ft. runways.

▶ **Cubana** has ordered four Viscount 810-40 turboprop transports for delivery late in 1958. The Cuban airline has three Viscount 700s in service. Viscount sales now total 327.

▶ **Hawaii's** Affiliated Chambers of Commerce plan a campaign to convince the Civil Aeronautics Board it should allow the airlines to absorb local fares between Honolulu and island points in their West Coast-Honolulu fares. The idea was tried out for a few months in 1950 before the CAB clamped down and made the carriers give it up.

▶ **Italian Study Center** completed a program for establishment of helicopter service in Italy. The plan calls for a new Italian company to operate an S-55 service starting in 1956-57 with flights between Rome and Naples, Naples and Capri, Naples and Ischia, Naples and Amalfi and Rome and Sienna. In 1957-58, the plan calls for expansion of service to Viareggio, Rapallo, Genoa, Monte Carlo and Nice.

▶ **Lines Aeropostale Venezolana** plans to extend its twice-weekly Panama service to Nicaragua and Guatemala this year. The Venezuelan Government is reportedly completing negotiations for the new service.

▶ **Mexico** is spending $720,000 this year for improvement of its airports and repair of airport rain damage.

▶ **North Central Airlines** will redeem immediately all of its 10-year 6% debentures due July 31, 1964. The debentures are convertible to common stock at the rate of one share for each $3 principal amount of the debentures.

▶ **Oakland** has published a Flight Selector to promote flights at Metropolitan Oakland International Airport. The selector affords easy reference for information on 150 daily flights arriving at and departing from Oakland.

▶ **Rome's Intercontinental Airport** of Fiumicino has received a $15 million appropriation from the Italian Ministry of Public Works to complete the work initiated under an original appropriation of $27 million.

▶ **Seattle-Tacoma** International Airport handled 107,708 passengers in May as compared with 99,331 in May, 1955. The airport handled 470,243 passengers during the first five months of the year, an increase of 35,470 over the same period of 1955.

▶ **Trans World Airlines** will operate 195 domestic flights daily this summer with 52% of its seat-miles in tourist service. The airline will have 100 flights a week in international service with 88% of the seats in tourist service.

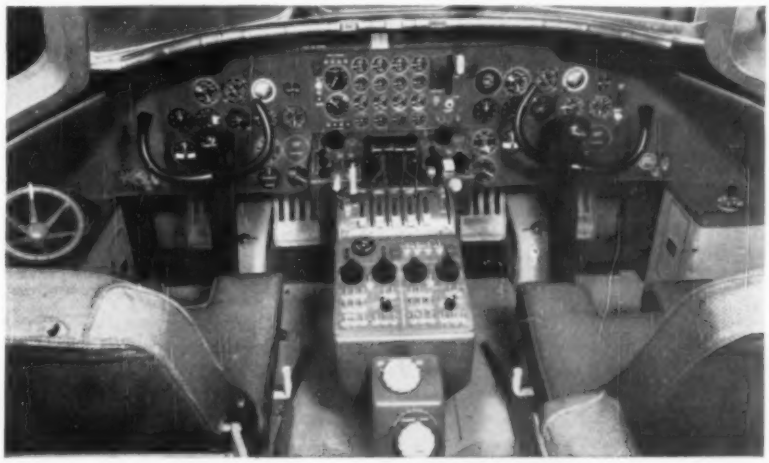
▶ **Varig Airlines** of Brazil purchased two Lockheed 1649As for delivery between December, 1957, and February, 1958. The new airplanes will be used on Varig's Buenos Aires-New York route.

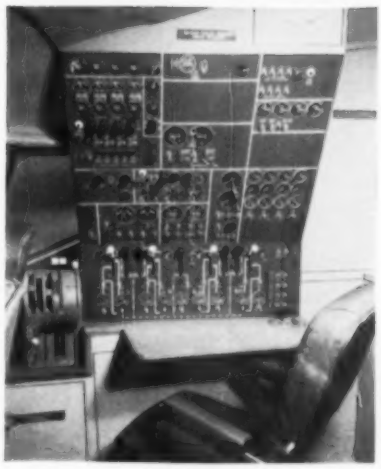
Improvements Made On Fokker Friendship

Improvements in the previously announced landing and takeoff characteristics of the Fokker Friendship turboprop aircraft have been reported by Fokker following the evaluation of data from a test program.

Field length for landing under sea level, standard atmosphere conditions now is estimated at 3,000 ft.; compared to 3,800 ft. previously estimated by Fokker.

Takeoff runway requirement with an all-up weight of 34,520 lb. is now estimated at 3,850 ft. Previous estimate called for 4,200 ft. of runway.





DC-8 Cockpit and Engineer's Station

Arrangement of instruments for new Douglas DC-8 jet airliner follows standardization concept of the Society of Automotive Engineers Aircraft Committee. Primary flight instruments and controls are located at the pilots' station (above) with two integrated flight instrument systems on each of the pilot's panels. This is to lessen interpretive errors and increase accuracy of pressure-operated instruments. Engineer's station (right) has separate panel confined to systems instruments and controls.

Keeping America

1916 Model C, pioneered international air mail service, between Seattle, Wash., and Victoria, B.C.

1927 The Boeing 40-A was one of America's earliest airplanes in transcontinental mail-passenger service.

1932 The 247, *first* 3-mile-a-minute [illegible] liner, set basic design for all modern twin-engine transports.

1942 B-29 Superfortress, world's first nuclear weapons carrier, backbone of America's heavy bombardment force in the Pacific during World War II.

1944 The Stratocruiser, spacious double-deck airliner, famed on luxurious "name" flights. Veteran of 200,000,000 miles, more than 30,000 ocean flights.

BOMARC. Supersonic guided missile, designed to strike enemy aircraft while still over areas well away from vital targets. Performance details are secret.

1952 B-52 eight-jet **Stratofortress.** World's leading intercontinental bomber. Speed: over 650 mph. Operating altitude: above 10 miles. Described by defense officials as "the most formidable expression of air power in the history of military aviation."

1936 B-17 Boeing Flying Fortress, *first* modern heavy bomber. Revolutionized aerial warfare.

1939 The 307, America's *first* four-engine, pressurized transport. First four-engine airliner in transcontinental service.

first in the air

1947 B-47 six-engine Stratojet medium bomber, America's current front-line nuclear weapons carrier, being refueled in the air by a Boeing KC-97, standard aerial tanker of the Air Force.

Here, climaxing an era of aviation achievement, you see America's *first* jet transport—along with other Boeings that have marked significant advances in aircraft performance.

Each is a product of imaginative Boeing design and efficient production. Behind each aircraft is a tradition of leadership that began 40 years ago this month, when Boeing was founded. During this span, Boeing created a succession of epoch-making aircraft.

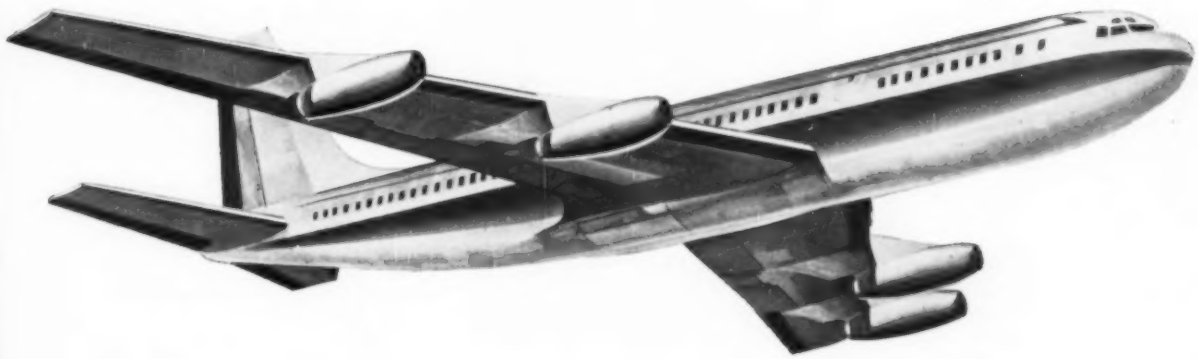
In Commercial Aviation—the pioneer 40-A; and the 247, first modern 3-mile-a-minute airliner; the 314 flying boat; the original Stratoliner, first pressurized transport; and the luxurious Stratocruiser, familiar around the world.

In Military Aviation—such trend-setting fighters as the PW-9; the revolutionary B-9 bomber, which could outspeed any contemporary fighter; the historic B-17 Flying Fortress and B-29 Superfort, culminating in today's revolutionary B-47 and B-52 multi-jet bombers.

And for Tomorrow—the 707 Commercial Jet Transport, the military KC-135 jet tanker-transport, and the defense weapons system based on BOMARC, Boeing's long-range, pilotless interceptor guided missile.

Boeing's 40-year tradition of leadership continues to help keep America *first* in the air.

BOEING



1956 The 707, America's *first* jet transport, ordered by eight airlines for delivery beginning late in 1958. Prototype holds transcontinental transport record: 3 hours, 58 minutes. KC-135 configuration will be world's first multi-jet aerial tanker.

Corporal Gives Army Nuclear Capability

Missile system provides artillery, gives commander striking force capable of delivering nuclear weapons.

By David A. Anderton

Ft. Bliss, Texas—The Army's Corporal short-range surface-to-surface ballistic missile is one example of a crash program that has paid off.

Originally the Corporal was the Corporal E, a research rocket and part of a joint effort by Army Ordnance Research and Development and the Jet Propulsion Laboratory of the California Institute of Technology. A crash program took the Corporal out of the research category and into field operations. Production of the system was delegated to prime contractors Firestone Tire and Rubber and Gilfillan Bros.

During the past year, eight Corporal battalions have been organized and trained, and six of these have been deployed to Europe. Some of the European units will be coming back soon for refitting with Corporal 2 equipment, an improved system now in production for the Army.

Guided Ballistic Missile

Corporal differs from earlier ballistic missiles such as the German V-2 because it is guid d after the motor is cut off as well as during the powered portion of the trajectory. The V-2 guidance system was based on a firing table with the powered flight path carefully programed before the rocket was fired.

Corporal also follows a pre-set trajectory, but its flight path is corrected by signal from the ground using computed data compared with the desired course. Radio signals from the ground also cut off the powerplant at the correct missile velocity, feed in a range correction velocity signal, and arm the warhead at the time of range correction.

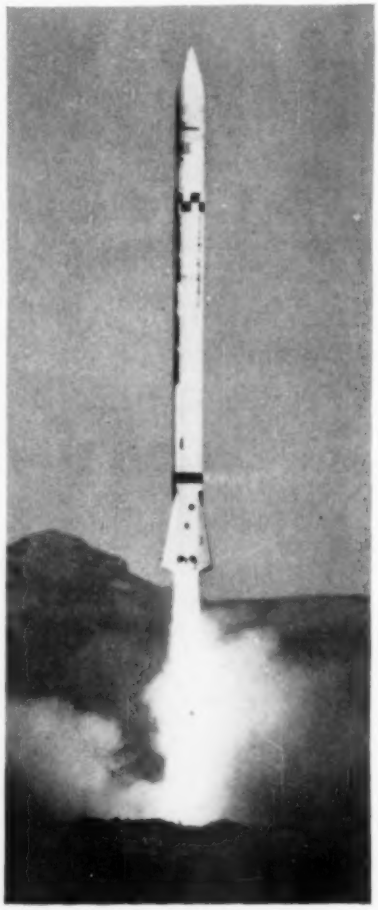
This makes it the world's first guided ballistic missile, says the Army. That statement assumes—perhaps naively—that the Russians have not yet gotten around to improving the V-2 guidance system.

The Corporal battalion is a means to an end. Its mission is to provide guided missile artillery fire in support of a field army. This kind of an operation gives the Army commander a mobile striking force with nuclear-weapon capability.

Approximate maximum range of the Corporal is 50 mi., but missions can be directed against targets at closer range. The missile batteries have all-weather capability, although there is a certain amount of optical tracking equipment that is a welcome aid during good visibility.

The Corporal missile (XM4E1 in the Army designation system) is part of a tactical weapons system that includes complete handling, servicing and maintenance equipment as well as the necessary erector, launcher and guidance gear.

Length of the missile is about 45 ft., diameter is 30 in. The ogival nose contains the warhead, which can be varied to suit the tactical problem. Just behind the warhead is the guidance package, containing most of the avionic equipment in the missile.



FIRST PUBLIC FIRING of Corporal missile at White Sands was witnessed by hundreds of newsmen about a month ago. A crash program took the Corporal out of the research category and into field operations.

The polygonal section behind the warhead guidance package houses a tank which holds the high-pressure air used to feed the propellants to the motors, sequence the valves and vent the propellants.

Center section of the Corporal contains the fuel and oxidizer tanks. Lines from them to the powerplant run along the outside shell of the missile in spines rather than through the center of the lower tank. The spines are visible in the pictures.

Fuel for the Corporal's rocket motor is mono-ethyl aniline; the oxidizer is red fuming nitric acid. The combination of these two propellants is hypergolic (self-igniting), so that as soon as they meet in the combustion chamber, ignition takes place spontaneously.

The rocket motor is mounted in the aft section. Four very small triangular fins mount the aerodynamic rudders and also form part of the supporting structure for four graphite jet vanes which protrude into the exhaust jet for steering during the powered phase of flight.

These small tail surfaces represent the major external change from the Corporal E, which had much larger trapezoidal fins and rudders.

Battalion Organization

Total complement of a Corporal battalion is 249 officers and men, divided into two batteries. One of the batteries is responsible for the complete technical operation of equipment and the missile launchings. The other is a headquarters battery with administrative responsibilities.

This organization is a recent change from the former setup which had two firing batteries and one radar battery under the battalion. The change was made last September for greater operational flexibility.

There are three general categories of enlisted personnel in a battalion:

- **Operators,** who handle the specialized equipment in the tactical problem.
- **Maintenance and repair,** who are trained for field care of the equipment.
- **Common specialists,** such as cooks, clerks and motor personnel.

Operator personnel total 94. Of

MEN OF THE 601ST Missile Battalion, Ft. Bliss, Tex., dressed in special acid resistant suits made of Polyethylene, during fueling of Corporal.

MEMBER of battalion using remote control box to erect Corporal on launcher.

CREW makes final check before firing.

THE 601ST Missile Battalion receives its Corporal servicing boom truck equipment.

these, 27 are launching crewmen, eight are electronic assemblers, 39 are mechanical assemblers and 20 are fire-control crewmen. These men form the major part of the two platoons—one for firing and one for guidance—that make up the battery.

Field Firings

A Corporal firing battery moves into its tactical area in a motor convoy of a score of vehicles and trailers. These are arranged on four sites: checkout, servicing, guidance and launching.

The missiles, in re-usable containers, their warheads and propellants have been transported to the battalion storage dump by ammunition train from the Ordnance ammunition supply depot. Procedures for handling rounds of this and other Army missiles are the same as for small-arms or artillery ammunition. Logistically the Army treats missiles and .30-cal. rounds alike.

Standard flat-bed trailers and trucks are used to move the missiles from the dump to the checkout area where the Corporals are placed on handling racks. Here begins the long sequence between receipt and firing. Several hours will separate the battery arrival on site from the first firing.

Mechanical and electrical checks are made on the racks before the missile is cleared from the checkout area.

The big 28-ton LeTourneau erector rumbles up to the checkout area with its power train screaming. This versatile vehicle is used for short-haul transport of the missile from here until it is fired. The power train is a gasoline engine driving AC and DC generators which in turn drive electric motors. Each gigantic wheel is powered by a separate DC motor for individual drive. Six AC motors handle the tasks of steering, missile motion and cooling of the engine and the other systems in the erector vehicle.

The driver hops out and takes a remote control box from the rear section of the erector. He now has complete control of the vehicle from this unit and can move it or the missile with an accuracy of a fractional inch.

Corporal Servicing

With the Corporal secured to the boom of the erector, the vehicle lumbers to the servicing area for propellant filling and warhead mating.

The erector operator swings the boom through a 180-degree arc to position the Corporal horizontally behind the erector for the fueling operations. Fueling personnel in their protective clothing prepare the two trucks for the operation.

Four barrels of aniline, mounted on

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Space prevents us from listing all the reasons we believe you will find significant. There are many others. But if our brief remarks make sense to you, write us and we can explore your opportunities at Lockheed through personal interview or phone. The brief resumé below is simply for your convenience in contacting us.

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a single truck, carry the fuel for two missile rounds. Nearby, two spherical tanks of red fuming nitric acid, also mounted on a single truck, are ready for emptying into two Corporals.

Standing by are safety personnel with a fire truck, a water truck with a shower, and an ambulance.

Propellants are filled by gravity from the gimbal-mounted tanks. Decontaminants, stored on the fueling trucks, are used to wash down the area if either fuel or oxidizer is spilled.

Both are dangerous. RFNA is highly corrosive and produces skin burns. Aniline is a skin irritant and has toxic fumes.

A standard Army M246 wrecker is driven up, towing a Linn Coach and Truck XM143 warhead trailer carrying two Corporal warheads. One is moved from the trailer to the missile by the wrecker crane and crew and is then fastened to the Corporal nose frame.

The loaded Corporal round is moved to the launching area for last-minute operational checks and servicing. The launching stand is brought up, set in place and made ready to receive the missile. The erector positions the missile carefully above the launching table and eases it down to the attachment points. The Corporal has stability on the launcher in winds up to 55 mph.

Last Checks

With the missile placed on the launcher, the firing platoon marks an X-30 minute readiness. Only tasks remaining are the pressurization of the air tanks and last-moment checks of the missile equipment. These will be done on a strict time schedule during the next 30 minutes on commands from the battery control station nearby, which is sandbagged.

An unusual servicing platform is in the launching area. Designated XM280E1, this unit is hydraulically operated by the operator who can raise the boom to service any part of the missile. The work area on the end of the boom accommodates two men for these final checkouts.

Two Firestone trucks—the XM301E1 compressor unit and an air servicing unit—stand by the launcher. Behind a sandbagged wall is the battery firing station. Also behind the wall is a Gilfillan truck which supplies the electrical power to the missile electronic components and to the remote firing panel located either behind the sandbags or in a foxhole.

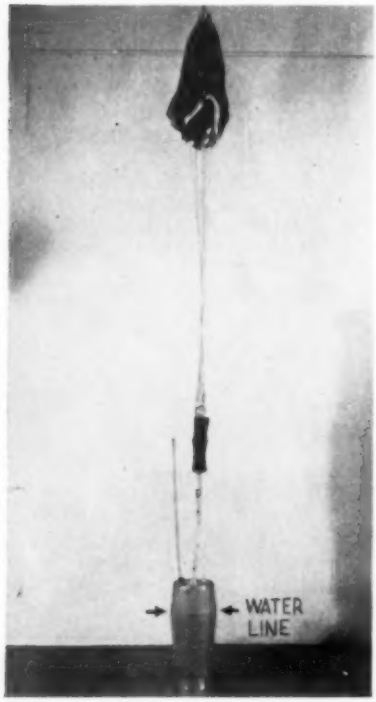
Ground Guidance

The guidance platoon which moved into its position several hours back has been busy ever since setting up its equipment, lining up the guidance radars and checking all the fire-control gear.

The platoon has seven major pieces of equipment to get operational and completely checked out before the X-30 mark can be called:

- **An/MPQ-25 tracking radar,** built by Gilfillan, which was basically a standard gun-laying set adapted to the different standards of missile operations.
- **AN/MSA-6 computer,** also a Gilfillan unit, for comparison of actual and desired trajectory data.
- **AN/MRQ-7 Doppler radio** which measures missile velocity and transmits the control signals for certain operations.
- **Three generators** for supplying the power required by these units.
- **Battery control station,** which is the communication net between the stations of the guidance and firing platoons.

If this were a test firing on the range at the White Sands Proving Ground



Hurricane Rocket

Instrumental rocket nose cone with parachute, sea anchor and recovery lines used to photograph hurricanes. Project is under sponsorship of the Office of Naval Research. Rocket would provide photographs of hurricane cloud from an altitude of approximately 100 miles. The flotation test rocket nose cone, which is carried aloft by the Nike-Cajun, will contain two 16mm. cameras and two free-running beacon transmitters for tracking. The sea anchor, dye markers and spent rocket fall into the sea. Tests by Navy to determine recovery feasibility of nose cone have just been completed near Wallops Island, Va.

advanced technique

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fighter situation display by AVION

Fighter Situation Display (FSD) is an automatic, continuous indication on a map of the aircraft position during flight.

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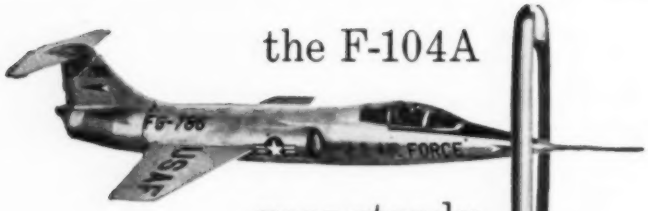
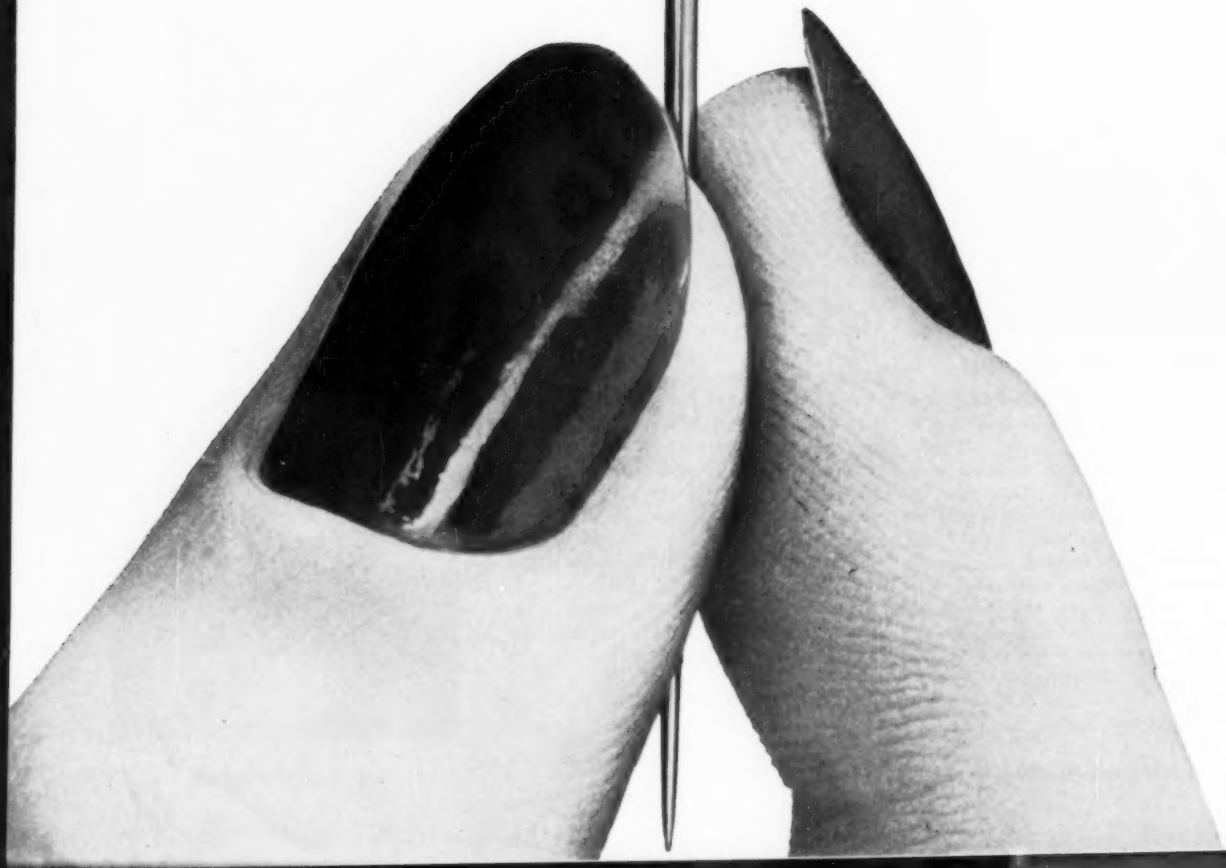


the F-104A goes steady with Lear

The faster-than-thought speed of the Lockheed F-104A Starfighter has been made practicable by the automatic flight control system designed and produced by Lear in collaboration with Lockheed engineers. By damping out undesired oscillations in *all* axes more quickly than they can even register in a pilot's brain, Lear's 3-axis stability augmenter provides an ease of control comparable to a basic jet trainer.

Lear Inc.
Santa Monica, California



there would be another piece of equipment: the instrumentation van.

After each part of the system has been checked as an individual item, the complete system is checked and the platoon is ready for X-30 time.

Last Half Hour

The battery receives its target by phone from the Army commander in a field exercise or by program in a test firing. The coordinates are established and the firing table determines the flight path for the missile.

Battery control takes over. The speakers start the countdown of the last thirty minutes: "At any command the time will be X-30 minutes . . . X-30 minutes . . . Mark! . . . Time is now running at X-30 minutes."

At X-30 the final operations begin, time-sequenced from the battery control station. The air servicing trucks move in and pressurize the missile to 2,350 psi. in its air tank. The servicing platform moves in also and two technicians raise the boom to the guidance section, make a quick check, and come down again.

Every five minutes the battery hears the time signal until the time runs at X-5 minutes. Then the signal speeds to a one-minute interval. The launching area is cleared; behind the sandbagged dugout the firing officer huddles, waiting tensely for the shock of ignition, the roaring of the rocket motor, the rising missile.

The final countdown is by seconds to the zero mark, then by letters through the four-second period after the firing button is pushed and before the missile is airborne. The voice cuts through the tension: ". . . Four . . . Three . . . Two . . . One . . . Zero. . . ."

"A!"—the valves slap open and the air free of restraint shoves the viscous aniline and the red-misted nitric acid through the lines toward the motor.

"B!"—the propellants slam through the injector head, meet in a flame. From outside can be seen the first wisps of smoke and the first noises break through the speaker's voice.

"C!"—the motor is roaring like Niagara, like a wild blowtorch next to your ear, like a thousand screaming women. The dust billows away in rushing clouds from the base of the launcher. Shock and noise and dirt and pebbles splat against the sandbags.

"D!"—and the Corporal lifts off the stand balanced on a pillar of fire and accelerates smoothly upward.

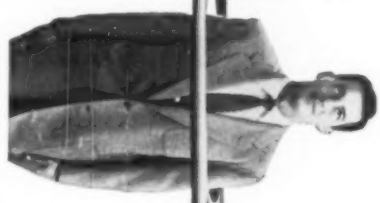
Eyes Have It

Over in the guidance station the blank eyes of the tracking radar have singled out the slim shape hurrying upward and have positioned it in space

Nacelle at Cornell

Lockheed Electra power package built to 0.37 scale has been tested on the propeller dynamometer in the 8½ x 12-ft. variable density wind tunnel at Cornell Aeronautical Laboratory. The model is an exact simulation of the engine air intake ducting. Tests were run at speeds up to the tunnel maximum of Mach 0.75 and a maximum top speed of Mach 1.1. Tests included investigations of the effect of propeller cuffs, de-icing boots, simulated ice formation and the geometry of the blade spinner juncture on propeller performance. Studies were also made on the effects of these parameters on air inlet duct performance and pressure recovery at the engine compressor face. Cornell also has completed 50 hrs. of stability and control testing on a 1/16-scale model of the Electra.

are YOU
the engineer
who can fit?



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by elevation and azimuth angles and slant range. This data goes to the computer which compares the missile position with the desired location on the flight path which will take it down into the target.

Back from the computer comes corrected data, coded to ride the radar beam back to the missile to correct its flight path. Minute motions of the jet vanes deflect the exhaust blast and produce lateral components of the thrust for course correction.

The Doppler radio, hearing a changing frequency from the beacon in the missile because of the acceleration of the Corporal, translates the frequency to a velocity. Continuously the radio checks the missile speed until the cut-off velocity is near.

Now at 60 seconds, high above the scarred terrain, the motor is silenced by a command signal from the ground. A second signal arms the warhead while the missile is still coasting upward to the zenith of its trajectory.

In the guidance vans the radars track through the long seconds remaining in the flight. Over the top and down the far side of the flight path plunges the Corporal. In a supersonic dive, it smashes into the target, dead just 225 seconds after it roared into life on the firing stand.

Nearly four minutes elapse before the firing crew knows certainly that the missile impacted in the target area. In a tactical exercise, it may take much more time to find out if the target was hit directly, or what was the circular error of probability.

During a recent test firing of a Corporal at White Sands, one of the officers was asked if it hit the target. "Yes, it hit the target," he replied. "How close was it?" persisted the questioner. "It hit the target," repeated the colonel. "That's what we aimed at."

Lockheed Air Service Opens Expanded Base

Ontario, Calif.—Lockheed Aircraft Service, Inc. formally opened its expanded base at Ontario International Airport, marking the consolidation of its operations with those recently moved here from Burbank.

The LAS Ontario base began operation in 1952 and has grown to cover 93 acres. Staffed with 3,000 employes, it is now chiefly occupied with the maintenance, repair, overhaul and modification of F-94 fighter-interceptors, B-50's for Air Weather Service, and P2V patrol planes. P2V-Ts also are being fitted with jet pods.

Robert E. Gross, president of Lockheed Aircraft Corp. and principal speaker at the opening ceremony, pointed up the prospects of LAS, a Lockheed subsidiary. He indicated that at least two factors, the increasing complexity of military planes and the unsolved problem of personnel turnover in the lower ranks of the armed forces, will spell out a steadily increasing volume of maintenance and modification business for private aircraft firms.

"While the military services must remain very largely self-sufficient and be able to keep their air fleets in a constant state of readiness," he said, "the constant changing of staffs in the lower ranks have made it difficult for the Air Force and Navy to have enough of the proper skills always. Consequently there has been more work of this sort offered each year to the aviation industry."

He revealed that last year the sales of LAS at Ontario were $44 million. Floor space in the LAS base buildings totals 367,000 sq. ft. Hangar area is 225,000 sq. ft.; stores and cribs, 68,532 sq. ft.; shops 51,895 sq. ft.; and a radar lab, 10,050 sq. ft. The administration building, just completed, has 42,000 sq. ft.

Other facilities: wash racks, 33,600 sq. ft.; shipping and receiving, 6,790 sq. ft.; cafeteria, 11,775 sq. ft. Miscellaneous areas account for an additional 44,000 sq. ft.

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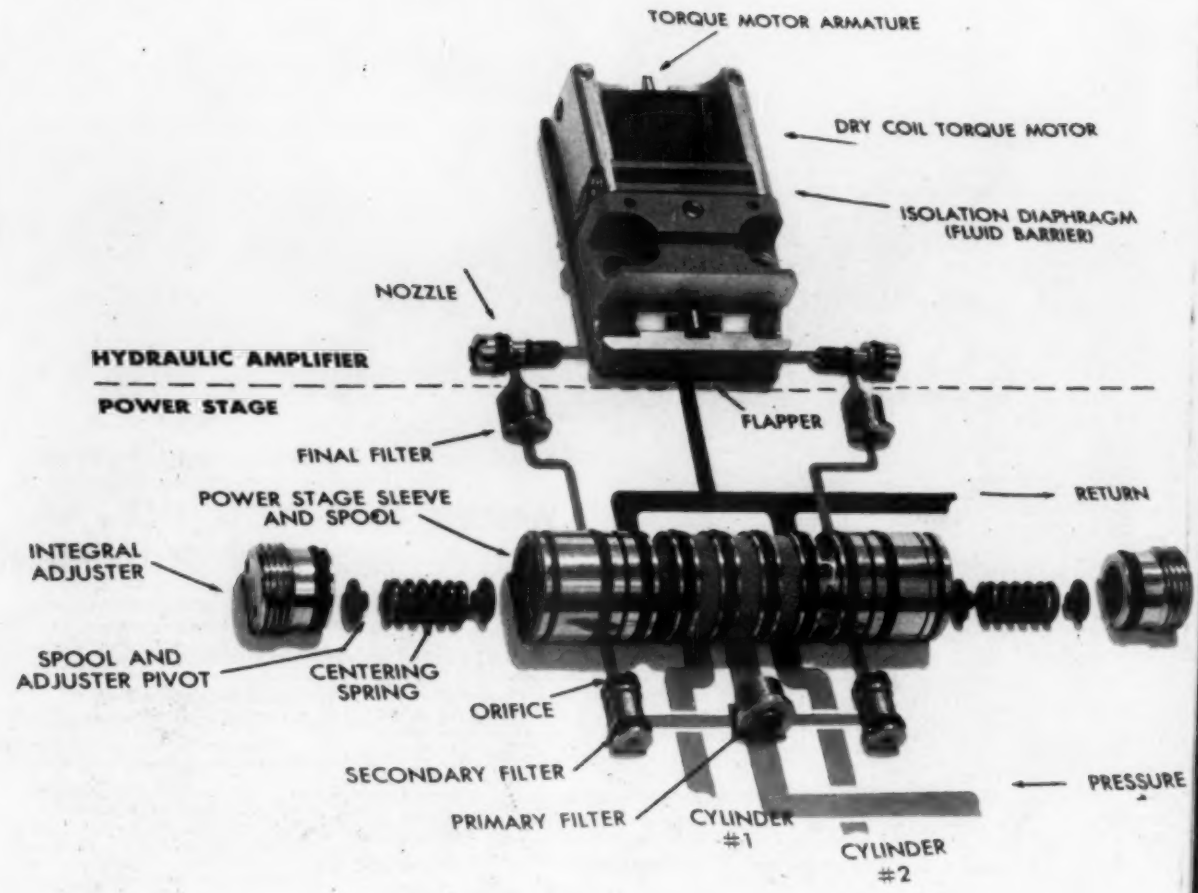

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The Hydraulic Research Dry Coil Servo Valve utilizes an isolation diaphragm that acts as a fluid barrier permitting coil and magnetic circuitry to operate in air for peak efficiency without danger of contamination.

Added assurance of trouble-free performance is provided by five internal micronic filters of corrosion resistant steel. All oil passes through three stages of filtration before reaching hydraulic amplifier.

Null adjustments, centering springs and control spool are all housed in the power sleeve. All are stainless steel and are not subject to different coefficients of expansion. The result is excellent null stability under all conditions. Integral construction of sleeve and adjustments, and micro finishes reduce valve hysteresis and threshold to absolute minimum with increased valve life a by-product.

The Hydraulic Research Dry Coil Servo Valve is available in quantity for high performance flight control systems.

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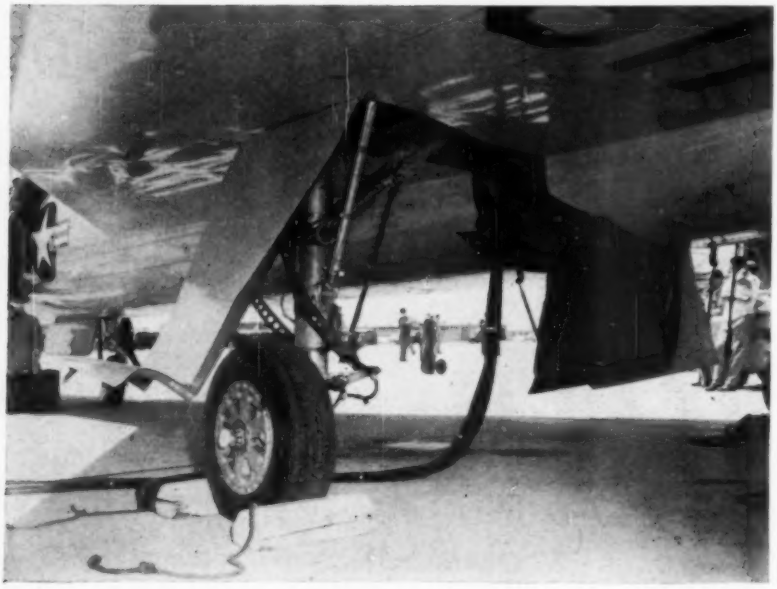
CHALLENGING ENGINEERING POSITIONS OPEN

VERTICAL TAIL (top) of F-102A mounts avionic antennas at tip and in lateral projections just below tip. Rudder is mounted low to reduce roll-coupling effects. Unpainted portions of tail cone are titanium structure. New tail with increased area is being phased into F-102A production lines. Split speed brake also doubles as cover for drogue chute compartment (right). Variable nozzle of Pratt & Whitney J57 turbojet is controllable for maximum thrust curing normal and afterburning operations. Afterburner flameholder is three concentric gutter-shaped rings. Wheel well (bottom) contains single-point fuel filler, ground power connection and other servicing outlets. Landing gear design and production is by Menasco Manufacturing.



Convair Improving F-102A for USAF

Convair's F-102A delta-winged all-weather interceptor is, according to many of the military pilots who have flown it, an excellent airplane and a weapon system that has an outstanding potential.

Evidence of the basic capability of the craft lies in the announcement that the company is starting production of the F-102B, aimed at even greater weapon potentialities (AW June 11, p. 50).

The powerplant for the B series will be the Pratt & Whitney J75, rated in the 15,000-lb. thrust class. One expected dividend of the new engine-airplane combination will be improved altitude capability to cope with the reported operational altitudes of 57,000 ft. reached by the Russian long-range Bison bomber.

Other changes that can be expected in the F-102B include improved missile armament, redesigned vertical tail (the current vertical delta tail is too small and is being replaced now with a larger surface), and a fuselage contoured from the start according to the area rule instead of being later gouged and blistered.

F-102As are now being delivered to operational squadrons. The first unit being equipped is the 327th Fighter-Interceptor Squadron, which is presently based at George AFB, Calif.

New Fastener Created By American Screw

Willimantic, Conn.—A new type of screw fastener is being used by North American on their F-100s, according to officials of the American Screw Co. here.

Called Torq-Set, the fastener features a specially slotted head which will permit 5-10 times greater tightening forces.

This allows the fasteners to be pulled up past the point where they are affected by vibrationary fatigue, says American Screw.

What at first looks like a slightly skewed version of the American Screw Co.-owned Phillips-head turns out to be a much refined shape designed to both hold the torqing tool in place and give it something to work against. At the same time, says American, the recess actually improves the fastener's resistance to impact.

A special driving tool is needed for each fastener size.

Torque-wise, where a Phillips-head driver would lift out and chew up the screw face at 50 in.-lb. on a ¼ in. screw,

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- Complete freedom from surface embrittlement due to gaseous contamination.
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- Greatly reduced machining costs—for example jet blade airfoils require polishing only.
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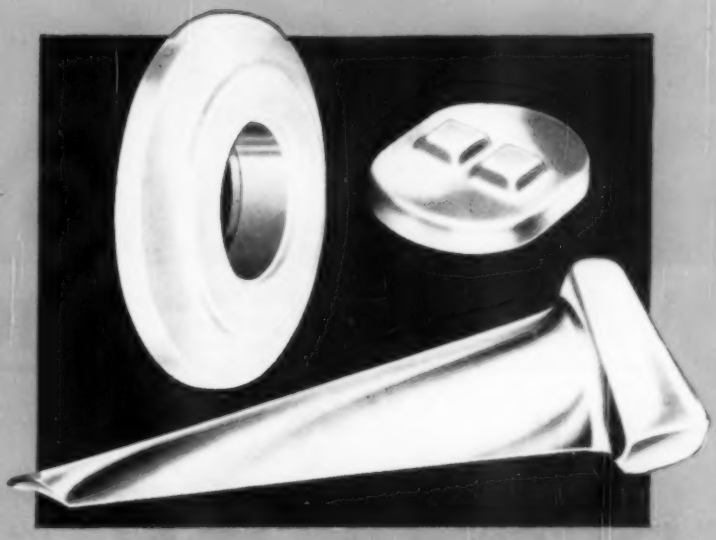
Besides taking the lead in Titanium, CSI are also highly skilled and experienced in the production of high temperature alloy forgings and in forgings or castings of aluminum and magnesium.



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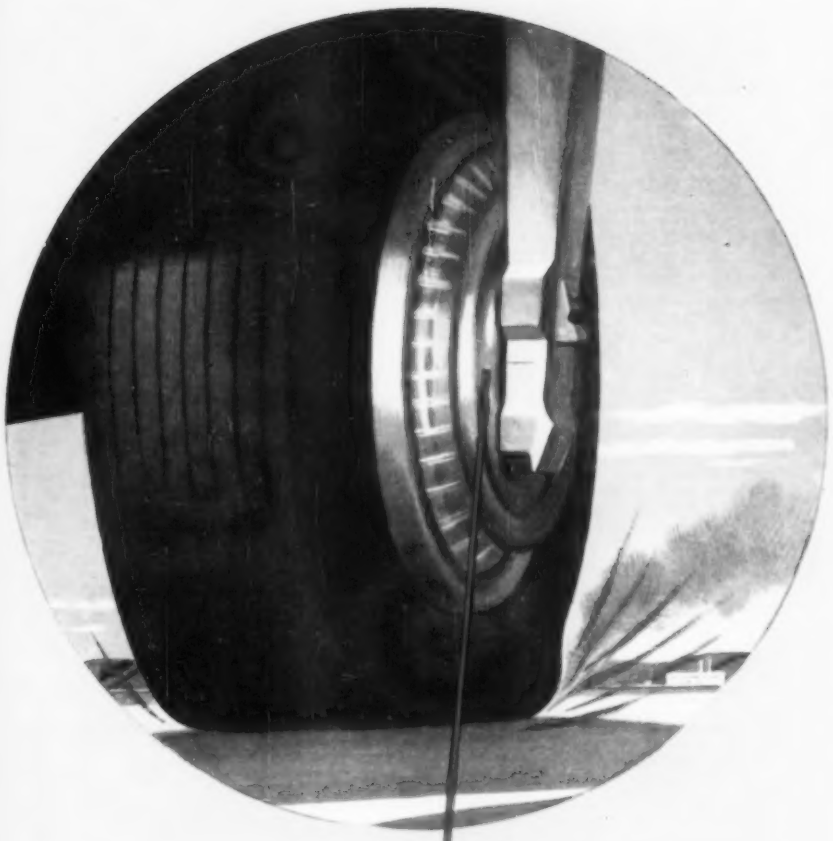

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reduced as much as 20%—automatically! The pilot is free to concentrate on other vital duties! Greater overall safety is assured!

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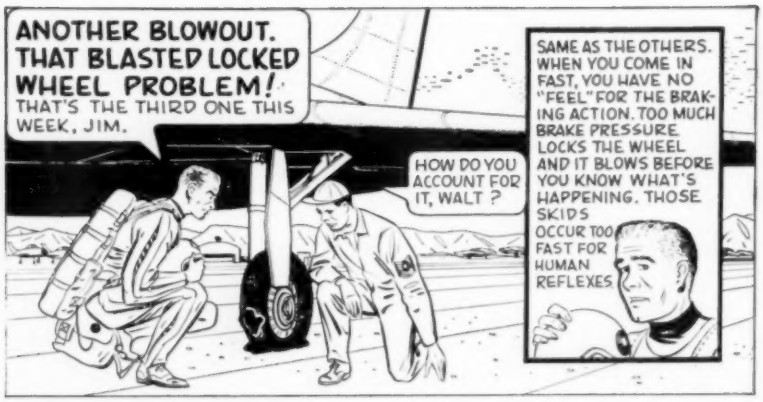
ANOTHER BLOWOUT. THAT BLASTED LOCKED WHEEL PROBLEM!
THAT'S THE THIRD ONE THIS WEEK, JIM.
HOW DO YOU ACCOUNT FOR IT, WALT ?
SAME AS THE OTHERS. WHEN YOU COME IN FAST, YOU HAVE NO "FEEL" FOR THE BRAKING ACTION. TOO MUCH BRAKE PRESSURE LOCKS THE WHEEL AND IT BLOWS BEFORE YOU KNOW WHAT'S HAPPENING. THOSE SKIDS OCCUR TOO FAST FOR HUMAN REFLEXES

EXCESSIVE TIRE WEAR... FLAT SPOTTING... BLOWOUTS. IT'S BECOME A BIG HEADACHE WITH THESE SUPERSONIC BABIES, WALT. I'VE BEEN READING ABOUT THIS "HYTROL" ANTI-SKID BRAKING SYSTEM AND ...
YEAH, BUILT BY HYDRO-AIRE. THAT REMINDS ME--THEY'VE INSTALLED "HYTROL" ON ONE OF OUR SHIPS. I'M SCHEDULED TO CHECK IT OUT TOMORROW. WONDER IF THAT'S THE ANSWER.
THE NEXT DAY IN THE OFFICE OF THE CHIEF TEST PILOT
MEET ORV WILKINSON FROM HYDRO-AIRE. HE'LL EXPLAIN HOW "HYTROL" HELPS YOU MAKE SURER, SHORTER LANDINGS IN THAT NEW SHIP.
"HYTROL" SUPPLEMENTS THE REGULAR BRAKING SYSTEM. IT SENSES THE INCIPIENT SKID AND RELEASES THE BRAKE TO PREVENT IT...THEN IT RE-APPLIES BRAKE PRESSURE IN A RAPID "ON-OFF" ACTION, FOUR TIMES A SECOND.

THE BASIC UNIT OF "HYTROL" IS A SKID DETECTOR MOUNTED IN EACH WHEEL. EACH SENSES THE SKID AND TRANSMITS AN ELECTRICALLY CONTROLLED SIGNAL TO A SOLENOID VALVE IN THE BRAKE PRESSURE LINE. FAIL-SAFE ACTION ASSURES BRAKES UNDER ANY CONDITION.
YES, IN TESTS "HYTROL" HAS DECREASED THE LANDING ROLL BY AS MUCH AS 30%. THE PILOT MAY LAND WITH BRAKES FULLY APPLIED AND KEEP FULL PEDAL FORCE. "HYTROL" PREVENTS BRAKE ENGAGEMENT PRIOR TO TOUCHDOWN AND THE WHEELS WON'T LOCK IF THE PLANE "PORPOISES."
WALT'S BRINGING HER IN NOW, MR. WILKINSON. GOOD LANDING!

I'M SOLD ON "HYTROL," JIM. THAT WAS AS NICE A LANDING AS I'VE EVER EXPERIENCED.
NOT A MARK ON THE TIRES, EITHER, AND NO OVERHEATING OF THE BRAKES. YEP, HYTROL'S THE ANSWER TO LANDING A SUPERSONIC FIGHTER.

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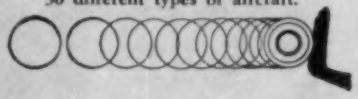

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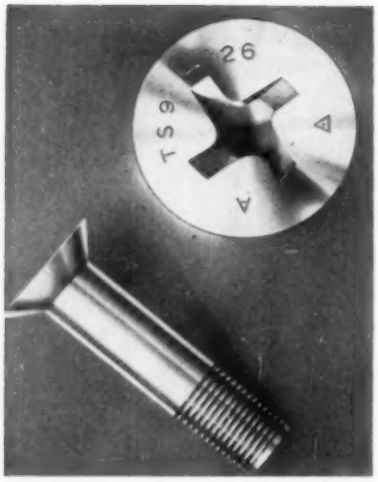


NEW CONCEPT in fastening conceived by American Screw Co. which claims tighter tightening, greater wrenchability, than any other type known, including its own Phillips-head patent.

the Torq-Set driver will be able to crank in 250 in.-lb. before the special driving head "strips" the slots.

The American Screw Co. intends to employ the same industry licensing policy with Torq-Set that they have followed on their Phillips-head patent.

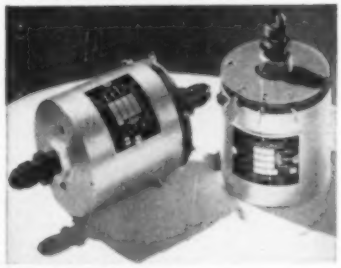
Lockheed Engineers Improvise Ice Impact

Marietta, Ga.—Lockheed Aircraft Corp. engineers in sunny Georgia must improvise to check effect of Arctic ice impact on C-130 Hercules.

An automobile is driven at 100 ft. per sec. to simulate landing speed of the C-130 Hercules. A 40-lb block of ice, suspended from steel brace on speeding car, scrapes a fuselage section lying on runway.

Hercules, turbo-prop cargo and troop carrier that operates off short, unprepared fields, is being built specifically for 18th Air Force.

AIRCRAFT TRANSDUCERS



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Construction: Hermetically sealed.

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Range: ± ¾ psi, differential.
Resolution: 1×10^{-6} psid.
Zero stability: Better than 1×10^{-3} psid.

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Range: ±25,000 ft./min.
Time constant: 0.2 sec. at sea level to 2 sec. at 50,000 ft.

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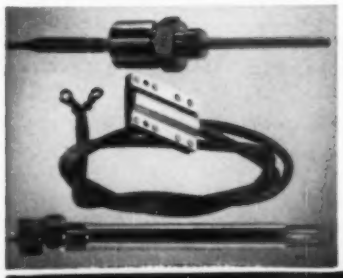

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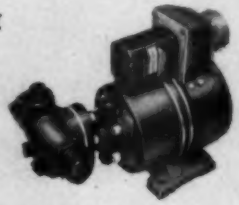
SPECIAL AIRCRAFT PUMPS

Eastern Aircraft Pumps are extremely small in size and light in weight. They are built to meet all appropriate government requirements under exacting conditions.
Six series of Eastern pumps described are representative models from the entire range of Eastern units, and provide a wide choice of performance characteristics.
Special model pumps or completely new units can be custom-made to your project.

THE 1700 SERIES is the *smallest* and *lightest* line of pumps ever made for delivering a small, yet accurate, volume of fluid against high pressures while operating at high speeds. When close-coupled to high speed motors, the size of the motor and pump combination remains small and light in weight. They are designed to meet rigid military specifications governing aircraft installations. Listed are a few of the many special pumps tailored to meet special requirements.



THE 1200 SERIES was designed to meet the requirements for greater flow than the 1700 Series. The displacement of the smallest pump in this series is 0.0154 cubic inches per revolution. The largest pump has a displacement of 0.0768 cubic inches per revolution. This series operates satisfactorily between a temperature range of —65°F to +160°F. They handle pressures as high as 1,000 p.s.i. and can be driven at speeds up to 6,000 R.P.M.

THE 1100 SERIES has similar performance characteristics to the 1700 Series. The displacement of the smallest pump in this series is 0.00838 cubic inches per revolution.
1101-S is flange-mounted pump. *1102-10R* is specially constructed of corrosion resistant materials; bronze housing, bronze gears, monel shafts, carbon bushings and synthetic rubber seals—designed to handle degreasing liquid.

THE 1400 SERIES Pumps are multi-element units of minimum weight and size designed to perform satisfactorily under severe conditions of low temperature and high altitude. These pumps have an aluminum housing, steel gears and shafts, synthetic rubber seals, and carbon bearings. The multi-element pumps are designed to meet requirements for scavenging and lubricating.

THE AR SERIES are commonly used as emergency stand-by fuel pumps. Motors are 1/50 H.P. aircraft type, 4500 R.P.M., available for 12 or 24 volt D.C. Size 6" x 4-⅜" x 2-¾". Weight is approximately 2-¼ lbs. Pumps are constructed of aluminum, and have mechanical rotary seals.

THE 100 SERIES is a continuation of the 1200 Series for still greater flow requirements. The displacement of the smallest pump in this series is 0.104 cubic inches per revolution. The largest pump in this series has a displacement of 0.365 cubic inches per revolution. Operates between a temperature range of —65°F. to +160°F. and pressures up to 1800 p.s.i.g.; speeds up to 3450 R.P.M.

Eastern
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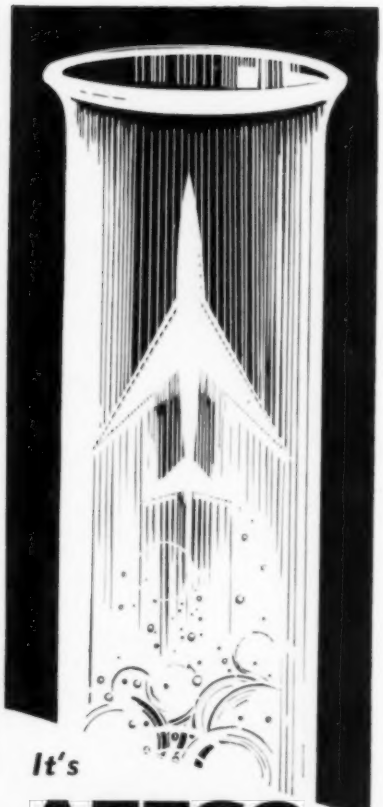
HAMDEN 14, CONN.

Write for Aviation Products Bulletin 330.



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Big Airframe Forging Challenges Martin

The aircraft industry may have to review its machine shop equipment in the light of the Glenn L. Martin Co.'s experience in machining the largest production forging fabricated yet for airframe use.

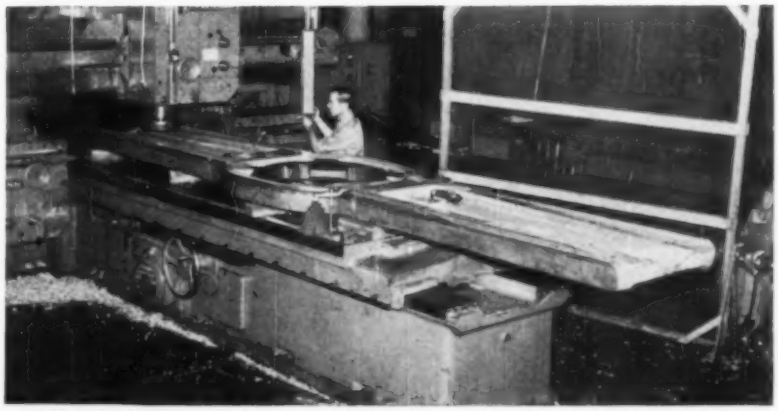
The 2,500-lb. forging is a wing spar member for a Martin B-57 tactical bomber modified for larger engines, presumably the Pratt & Whitney J57s planned for the B-57D model. Current powerplants are Wright J65s.

The forging was handled in the Martin shops on standard equipment, but ingenuity and improvisation were needed in large quantities. Five major operations were done before heat-treating and six finish machinings were done afterward; 66 production tools were used in the operations.

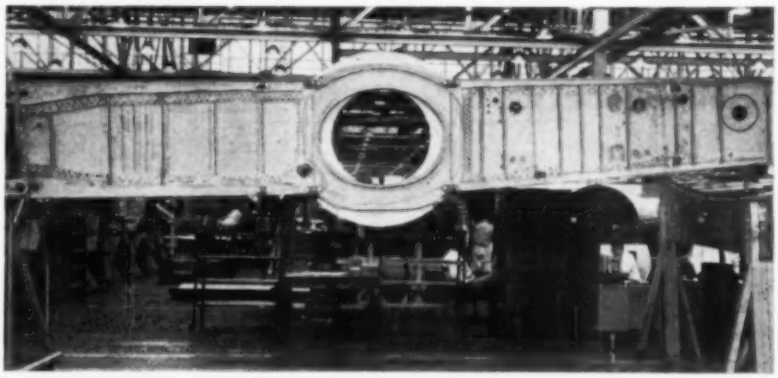
"Machine tools normally considered adequate for normal airframe work are too small for large forging work," said E. H. Parks, supervisor of Martin's Detail Process Planning Section. "We would be able to reduce the tooling required for this job if machines were available to perform all the operations in one position."

Size of the finished part is 15 ft. 7 in. long by 46 in. wide and 6 in. thick. Parks says that if production volumes were higher, it would be economically feasible to call for a more refined forging to reduce the number of machining operations.

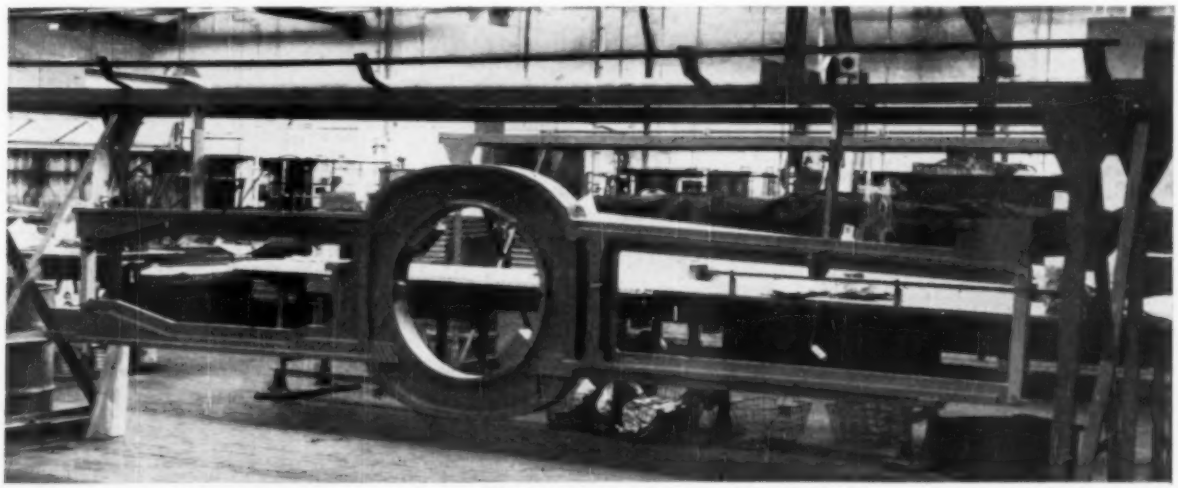
The forging is made on an 18,000-ton press by Bridgeport Brass Co., Adrian, Mich.



PLANING IS FIRST machining operation on this 2,500-lb. 75 S aluminum forging for the wing spar of a modified Martin B-57 bomber. Excess material is removed in this step.

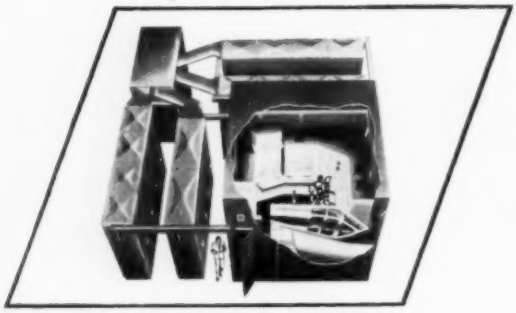


EARLY SPAR FITTING was limited in ability to take larger engines by distance between upper and lower spar chords. Forging was necessary for larger and stronger structure.



NEW FORGED SPAR FITTING contrasts with earlier model (above) in size of hole available to take larger engine. Forging has been rough machined and anodized at this stage; it is sent back to Bridgeport Brass for heat treatment and returned to Martin for finish.

ON THE GROUND
Simulators are the only sure way to train jet pilots



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USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

HEADQUARTERS, SHELBY AF DEPOT, Wilkins AF Station, Shelby, Ohio.

Douglas Aircraft Co., Inc., Long Beach Div., Long Beach, Calif., misc., spare parts for maint. platforms P/N K18202; K5415602; acft eng. trailer and 8220-750422-7 Eng truck P/N K5466550, 684 ea., (PR WL-547833, 547855), $40,601.

Aeroquip Corp., 300 South East Ave., Jackson, Mich., hose assemblies, 14638 ea., (PR WL-548281-1, 548288), $119,818.

Seymour Wallas & Co., 1200 S. 8th St., St. Louis 4, Mo., coveralls, anti-G; type MB-2 law spec MIL-C-9277A, 8174 ea., (IFB 33-602-56-59), $373,960.

Boeing Airplane Co., Seattle Div., 7755 E. Marginal Way, Seattle 14, Wash., spare parts for 8200-903300 towbar, 8220-F30144 hoist acft towbar 52111, F52114, Tir, F52221, eng sling assy, F52231 Dolly assy, F52245 Dolly assy, F52274 tir, F65841 acft eng acc maint stand, F65934 tall support F65980 fin folding jack, F66079 dolly F66156 hoist, F66162 truck F66179 dolly, and F66202 dolly, 212 ea., (PR WL-547889 thru 547896 and WL-547900 thru 547906), $29,914.

Barry Controls, Inc., 700 Pleasant St., Watertown 72, Mass., mounts, 66650 ea., (PR WL-548391-1, 548392-1, 548393), $43,-223.

Arrowhead Rubber Co., 2350 Curry St., Long Beach, Calif., flexible duct, hose air-duct, sleeve and nipples, 100296 ea., (PR WL-548216-1,2, 548242, 548294, 547684), $30,913.

Recony Corp., Reco Products Div., 150 Nassau St., N. Y., air conditioner type A3, 350 ea., (PR WL-405474), $1,452,689.

Stewart Steel Products, Inc., 1785 E. New York Ave., Brooklyn 7, N. Y., trailer, compressed Gas cyl 1 ton cap, type MB-2, 31 ea., data, total $52,189, (PR WL-547630,-1).

Auburn Rubber Co., Inc., 725 W. 11th St., Auburn, Ind., sheet, syn rubber solid smooth finish law spec MIL-R-6855, (IFB 33-602-56-112), 81729 sq. ft., $42,812.

HEADQUARTEDS, Middleton AMA, Olmsted AFB, Middletown, Pa.

Irving Air Chute Co., Inc., 1315 Versailles Road, Lexington, Ky., canopy, ribbon type, 645 ea, $59662, IFB PR MA-662726.

Reliance Mfg. Co., 350 Fifth Ave., New York 1, N. Y., canopy, ring slot type, 4820 ea, $221720, IFB PR MA-662723.

Reliance Mfg. Co., 350 Fifth Ave., New York 1, N. Y., pilot chute, 21600 ea, $100440, IFB PR MA-662722.

The Liquidometer Corp., Skillman Ave., 36th & 37th Sts., Long Island City 1, N. Y., indicator, oil, quantity, 475 ea, $29017, IFB PR OC-705376, 705377.

General Electric Co., West Lynn, Mass., indicator, position 1, 941 ea, $31994, IFB PR OC-705376, 705377.

Bell Aircraft Corp., (Helicopter Division), Fort Worth, Tex., iran maintenance 91 each H-13 type aircraft, 91 ea, $177552, PR MA-718718.

Reliance Mfg. Co., 350 Fifth Ave., New York 1, N. Y., riser, 1753 ea, $29538, IFB PR MA-662725.

The Liquidometer Corp., 41-03 36th St., Long Island City 1, N. Y., indicator, liquid quantity, 90 ea, $28620, RFP PR MA-598775, 662563.

AMC, Wright-Patterson AFB, Ohio.

Standard Coil Products Co., Inc., Kollsman Instrument Corp., Emmerick Optical Div., 80-08 45th Ave., Elmhurst, N.Y., type MA-1 true airspeed computer and transmitter, 1086 ea., (PR PE635819), $538,327.

Kearfott Co., Inc., 115 McBride Ave., Little Falls, N.J., indicators, master, 750 ea., controls, directional gyro, 598 ea., controls slaving, (PR PE 673542), $2,663,989.

The General Tire & Rubber Co., 1708 Englewood Ave., Akron, Ohio, wheel assys, acft data, 680 ea., (PR 00-542999), $36,723.

Standard Coil Products Co., Inc., Kollsman Instrument Corp., Emmerick Optical Div., 80-08 45th Ave., Elmhurst, N.Y., type A-1 machmeters, 1237 ea., (PR 598482, 598491 and 635842), $158,470.

Mitchell Camera Corp., 666 W. Harvard St., Glendale 4, Cal., 16mm motion picture camera, 11 ea., 35mm motion picture camera, 5 ea., motors for 16mm motion picture cameras, 9 ea., (MIPR R56-107-23375 G 6/1/ASO, R56-51-23375 G 6/2G/ASO), $110,663.

Allen B. DuMont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N.J., radio noise testing program, (PR 671417), $140,599.

Charles Beseler Co., 219 S. 18th St., East Orange, N.J., projector, type 1, size B, 587 ea., (PR 600070), $95,727.

Central Commercial Co., 332 S. Michigan Ave., Chicago 4, Ill., increase in quantity of spare parts, (PR 180879), $41,786.

Model Engineering and Mfg., Inc., North Lake St., Boyne City, Mich., indicator, position, landing gear, 3203 ea., individual indicating, 775 ea., (PR 635843), $37,594.

G. Felsenthal and Sons, Inc., 3500 N. Kedzie Ave., Chicago 18, Ill., plotter, type B2A, 38000 ea., computer, type X-1, 8666 ea., (PR MA 598761 and MA 598766), $66,278.

Lear, Inc., 110 Ionia Ave., Northwest, Grand Rapids, Mich., control; roll and pitch, remote attitude indicator, type MM-1, 23 ea., (PR PE 635993), $29,555.

Standard Coil Products Co., Kollsman Instrument Corp., Emmerick Optical Div., 80-08 45th Ave., Elmhurst, N.Y., type K-3 air speed indicators, 2028 ea., (PR PE 635880 and OC 665079), $225,629.

Radio Corp. of America, 11819 W. Olympic Blvd., Los Angeles 64, Calif., headset, adapter, microphone, MX-1646/AIC, 18731 ea., (PR 689258), $694,358.

General Electric Co., 2500 Far Hills Ave., Dayton 9, Ohio, generator, 760 ea., generator, 4 ea., control panels, 212 ea., (PR 635564), $1,737,195.

Continental Aviation & Engineering Corp., 12700 Kercheval Ave., Detroit, Mich., J-9-T-9 engines, production tooling, (PR 202525 and 673624), $9,312,766.

General Electric Co., Schenectady, N.Y., type E-31 tachometer indicators, 572 ea., (PR 705363 and 705354), $37,694.

American Machine & Metals, Inc., United States Gauge, Sellersville, Pa., gage, pressure, manifold, direct indicating, 2 inch size, 10-75 inch type MS 28018-1, 1144 ea., (PR OC 705353 and OC 705354), $52,097.

HEADQUARTERS AMC, Wright-Patterson AFB, Ohio.

The Glenn L. Martin Co., Baltimore, Md., furnish special components for fuel system installation and adaptation of spare parts for B-57B airplanes, (PR 11303), $320,000.

Lockheed Aircraft Corp., Burbank, Calif., twenty-five hours of flight testing of one turbo-prop engine, (PR PA 217411), $62,-463.

Giddings & Lewis Machine Tool Co., 142 Doty St., Fond du Lac, Wis., numerical director system, consisting of electronic computing director, tape recorder and regulated power supply, and furnished with operating supplies and spare parts, 3 ea., paper tape preparation desks, 12 ea., auxiliary test equipment for director system, 3 sets, (PR 709578), $901,323.

Bill Jack Scientific Instrument Co., Solana Beach, Calif., spare parts for type S-11 camera, 16 items, computer assembly, 15 ea., power assembly, 6 ea., power supply, 16 ea., (PR MO-664063), $29,330.

Wilcox Electric Co., Inc., 14th & Chestnut Sts., Kansas, Mo., data (PR PE-670789), $34,346.

Bell and Howell Co., 7100 McCormick Rd., Chicago 45, Ill., motion picture camera, 16mm. 25 ea., photographic printers, 13 ea., (MIPR R56-51-23375-G), $66,916.

Abrams Instrument Corp., 600-620 E. Shiawassee St., Lansing, Mich., modification kits for type B-94 intervalometers, 8055 ea., spare parts and data (PR MO-664112), $28,967.

General Electric Co., Specialty Heating Equipment Section, 10 Mansion St., Coxsackie, N. Y., cover, camera, electric heated, 1436 ea., (PR MO-664095), $19,858.

The Sperry Rand Corp., Sperry Gyroscope Co., Div., Great Neck, L. I., N. Y., trans-

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mitters, type C-2, 120 ea., compensations, transmitters, 1621 ea., (RFP PE-635917), $47,734.

Bruno-New York Industries Corp., New York, N. Y., MX-1646, 16283 ea., data (PR 642600), $428,176.

Bendix Aviation Corp., Pioneer-Central Div., Davenport, Iowa, transmitter, rate of flow, type J-7, 1247 ea., (PR 673527), $640,982.

General Electric Co., Hotpoint Co. Div., 5600 W. Taylor St., Chicago, Ill., accelerated amortization, (PR PE-673985), $26,712.

Motorola, Inc., 2710 N. Clybourne Ave., Chicago 14, Ill., indicator, range and azimuth, 28 ea., (PR 691850), $92,291.

Stromberg-Carlson Co., Div. of General Dynamics Corp., 100 Carlson Rd., Rochester, N. Y., radio beacon, 1170 ea., (PR 180889 and 642672), $1,870,010.

Fairchild Engine & Airplane Corp., Fairchild Aircraft Div., Hagerstown, Md., testing of power plant installation, (PR PH-205049), $65,002.

Pastushin Aviation Corp., 5651 W. Century Blvd., Los Angeles 45, Calif., pylon assemblies, parts and data, 162 ea., (PR 672512-1), $123,152.

Sperry Rand Corp., Remington Rand Univac, 1902 W. Minnehaha Ave., St. Paul W4, Minn., modification equipment for AEDC data reduction system, (PR 194116), $156,982.

Vard, Inc., 2981 E. Colorado Blvd., Pasadena, Calif., facilities for the production of J-57 engine components, (PR 708701), $74,735.

Hycon Manufacturing Co., 2961 E. Colorado St., Pasadena, Calif., lens cone, 36 inch F/4.0, for KA-10 camera, 4 ea., (PR 143051), $49,700.

Aircraft Radio Corp., Boonton, N. J., transverter ARC type TV-10, 356 ea., dynamotor DY-86 (ARM type D-10A-28V, 20 ea., spare parts and MT&TE, bulk maintenance data and engineering data lot, (PR PE-180882 and GE-642862), $120,198.

I. T. E. Circuit Breaker Co., Philadelphia, Pa., acquisition and installation of press, (PR 671042), $36,675.

Airtron, Inc., Linden, N. J., spare parts for CFE equipment, 9 items, (PR SA-611311), $108,203.

Radio Corp. of America, 11819 W. Olympic Blvd., Los Angeles 64, Calif., radio receiver sets, 236 ea., (PR 168043, 168043-1, 180888, 642710, R56-735-11), $1,186,397.

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J., central air data computer system, (PR 635987 and 635987-1), $2,818,682.

Lear, Inc., Lear-Romec Div., Elyria, Ohio, pump, pressure, oil free, 85 ea, dehyrator 168, ea., controls, pressurizing, 169 ea., (PR 635583, 635584, 635587, 635588, 642702), $86,490.

Bendix Aviation Corp., Red Bank Div., Eatontown, N. J., generators, aircraft, D.C., 200 amp, 30 volt (Inst), 150 ea., panels control, D.C., generators, high temperature, 150 ea., generators, aircraft, D.C., 200 amp 30 volt (spares), 97 ea., (PR-PE-635636 and PE-635632), $200,417.

Bell and Howell Co., 7100 McCormick Rd., Chicago 45, Ill., model J printer, 12 ea., maintenance data, 1 lot, (PR 599908, 59908-1 and 599[illegible]3), $55,636.

AC Spark Plug Div., General Motors Corp., Flint 2, Mich., gun-bomb rocket sight, type A-4,667 ea., spare components, spare parts and data MT & TE, (PR 709-778 and 421261), $2,834,869.

General Communication Co., 681 Beacon St., Boston 15, Mass., radio receiver, R-553/ARR-8B, 323 ea., radio receiver, R-55/ARR-8B (signal corps), 12 ea., technical publications, (MIPR R03-690160-SC-01-23 and Amendment #1), $204,530.

J. A. Maurer, Inc., 37-01 31st St, L.I. City 1, N. Y., camera set, still picture, KS-12, 41 ea., engineering data, 25 sets, Maintenance data, 1 lot, (PR MO-699974), $48,991.

O. E. Szekely and Associates, Commerce, Ga., rack assemblies, electrically operated, type T-1A, 1656 ea., engineering data and maintenance data, set, maintenance data, set, maintenance parts, lot, (PR WR-408-276), $352,589.

Benson Lehner Corp., 11930 Olympic Blvd., W. Los Angeles, Calif., oscillograph trace film reader, 1 ea., electric typewrite, 1 ea., electroplotter, 1 ea., decimal converter, 1 ea., (PR ATI-56-LP-112), $31,805.

Bill Jack Scientific Instrument Co., Solana Beach, Calif., incorporation of spare parts exhibit, (PR 671442 and 636295), $61,279.

DAYTON AF DEPOT, Gentile AF Station, Dayton 10, Ohio.

Bendix Aviation Corp., Bendix Radio Div., Baltimore, Md., 16 items of var quantities for relay assemblies, switches, tuning Unit-RF, nuts, relays and contact-assy, $27,526.

Bendix Aviation Corp., Bendix Radio Div., Baltimore, Md., 42 items of var quantities for coils, transformers, transformer assy, screws, clamps, circuit breakers, capacitors, switches, screws, tuners, shafts, $72,786.

Radio Corp. of America Tube Div., 19th and Federal Sts., Camden 2, N. J. Connector plugs, 5000 ea. and telephone jacks, 5000 ea., (PR 628584), $59,750.

Bendix Aviation Corp., Bendix Radio Div., Baltimore, Md., 9 items of var quantities for relays, capacitors and maintenance parts for airborne radio communication equipment, $96,939.

Western Electric Co., Inc., North Carolina Works, Chatham Rd., Winston-Salem, N. C., items of test leads, switches, relay assys., capacitors and terminal lugs, $29,699.

Philco Corp., 4700 Wissahicken Ave., Philadelphia, Pa., 202 items of maintenance parts for airborne radar equipment, $46,823.

Standard Electrical Products Co., 2240 E. Third St., Dayton 3, Ohio, 69 items of resistors, var quantities, in a/w specification MIL-R-11A dtd 17 Feb 53, amdt. No. 2 thereto dtd 4 Sep 53 and supplement No. 1A dtd 9 Jun 54, GE-690038, GE-659731, GE538904, GE-690039, GE-550155, GE-550189, GE-550161), $27,816.

Bendix Aviation Corp., Montrose Div., S. Montrose, Pa., armature-dynamotor Bendix Red Bank P/N RD-4925-1, 500 ea., (RFP 33-604-56-2788), $37,225.

Molded Insulation Co., 335 E. Price St., Philadelphia 44, Pa., insulator-antenna strain MX-270/AR in a/ USAF Dwg 47 B-40873 except that detailed dwg 47B40874 shall be with JAN-1-10 steatite, grade L5 or better, 6500 ea., insulator-antenna strain MX-273/AR in a/w USAF dwg 47 B-40873 except detailed dwg 47B40874 sall be with JAN-1-10 steatite grade L4 or better, 18000 ea., (IFB 33-604-56-117), $29,350.

The Jackson Electrical Instrument Co., 18 S. Patterson Blvd., Dayton 2, Ohio, junction box J-229 ()/ARN-14 in a/w military specification MIL-J-8093 dtd 14 Oct 52 and amdt No. 2 dtd 3 Mar 54, 137 ea., engrg data, maintenance data, (RFP 33-604-56-2153), $63,156.

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio, gage, internal comparator bench type Sheffield P/N N-6, 14 ea., commercial data, (RFP 33-604-56-12833), $33,960.

Aircraft Products Co., Church Rd. and Crooked Lane, Bridgeport, Pa., test set pitot static, type MB-1 in a/w specification MIL-T-8076A and amdt #2 dtd 18 Oct 54, except that paragraphs 3.12, 4.2.1., 5.2, 5.3, 5.3.1, and 6.3 are reteled, 300 ea., handbook data, (IFB 33-604-56-138), $82,350.

OFFICE OF SCIENTIFIC RESEARCH, ARDC, P. O. Box 1395, Baltimore 3, Md.

The Board of Trustees of the University of Illinois, Urbana, Ill., research-sudden expansions in compressible flow, (AF18-(600)-392), job, $28,417.

The Trustees of Columbia University, in the City of New York, N. Y., N. Y., research-stochastic processes and related problems of statistical inference, (AF18-(600)-442), job, $29,490.

Syracuse University, Syracuse 10, N. Y., research-study of paramagnetic resonance in semiconductors, (AF18(603)-50), job, $40,000.

The Board of Trustees of the Leland Stanford, Jr. University, Stanford, Calif.,

An Engineer Speaks Out...

...about the *Only* V.H.F. Communications Receiver

- that has a frequency range of 50-200 mc
- that is continuously tunable over the entire frequency range without switching
- that has AM-FM-c.w. selection
- that has variable bandwidth

This VHF Communications Receiver was developed at Servo Corp. to fill the need for a high quality, general purpose unit that could be used *both* in laboratory work and in the communication field. Built to the most exacting standards, this receiver also provides:

- automatic noise limiter
- exclusive squelch circuit
- patented 72" bandspread dial with a resolution of 0.1%
- maximum sensitivity: 1 micro-volt input or less will produce a 10-db signal plus noise-to-noise ratio over entire frequency range
- high frequency stability: less than 0.08% drift over line voltage range of 105-125 volts . . . over ambient of—10°C to +60°C temperature and 0 to 95% humidity
- less than 50 micro-micro watts radiated local oscillator power

Our VHF Communications Receiver is being used in general communications work; in the laboratory to calibrate other receivers; flight-testing; control tower; telemetering; propagation studies; evaluating transmitters; and meteor research.

For the full story on our VHF Communications Receiver, please fill in your name and title in the coupon below. Attach it to your letterhead and mail to me.

Jules Cardon
Staff Engineer
Radio Engineering Dept.

Electro-mechanical Control Systems and Components for Industry by

SERVO CORPORATION OF AMERICA

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Servo Corporation of America
20-20 Jericho Tpke., New Hyde Park, L.I., N.Y.

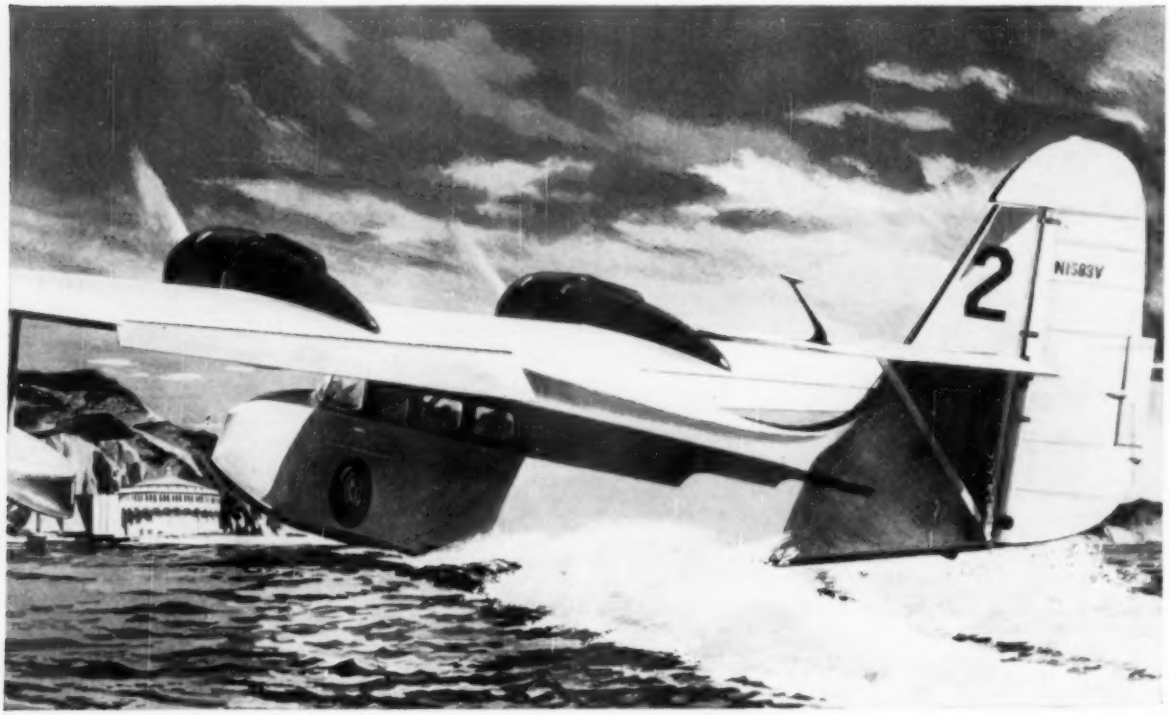
Please send me more information on V.H.F. Communications Receiver.

Name.....

Title.....

PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA

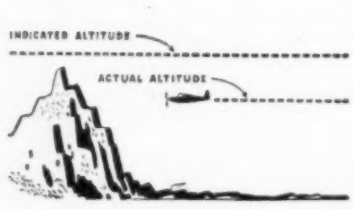


13,000 channel crossings in two years

Flying the world's shortest airline run, Dick Probert's Avalon Air Transport planes average 17 minutes a flight over the 32 miles between Long Beach, California, and Avalon Bay on Catalina Island. The route is one of the world's busiest, too, with up to 47 flights a day, and a total of 13,000 crossings and 75,000 passengers carried since the first flight in August of 1953.

"The open sea is one big airport for our Grumman G-21's," says Mr. Probert, "so our over-water flights hold few dangers. But they really give our 450-horsepower Pratt & Whitney's a workout. Long, full-throttle water take-offs, short flights, salt-water spray on the engines; they all call for the best possible lubrication. We get it, too—RPM Aviation Oil gives us 1100 hours between overhauls. And the engines are in good condition even after that time; we overhaul them just for preventive maintenance.

"Another problem we have is very high head temperatures because of our water take-offs. But Chevron Aviation Gasoline 30/87 prevents detonation, and gives us full power when we need it. Never fouls plugs, either."



TIP OF THE MONTH

It's not true that a pressure altimeter always gives actual altitude in flight. Temperature, outside pressure changes, etc., can cause errors as much as 2000 feet in altitude reading.

CHEVRON AVIATION GASOLINE

RPM AVIATION OIL

We take better care of your plane

T.M.'S "RPM," "CHEVRON," "PLANE FAX," REG. U. S. PAT. OFF.

research-a microwave spectroheliograph, (AF18(603-53) job, $143,920.

Aerojet-General Corp., Azusa, Calif., research. A study of the kinetics of solid phase reactions (AF18(603)-74), job, $42593.

SACRAMENTO AIR MATERIEL AREA, McClellan Air Force Base, Calif.

North American Aviation, Inc., P. O. Box 95, Fresno, Calif., prototype installation of advanced electronic equipment and IRAN of F86-D type aircraft, 9 ea. (P/R 352), $170000.

North American Aviation, Inc., P. O. Box 95, Fresno, Calif., IRAN and modification of F-86A type aircraft, 54 ea (P/R 34411), $345000.

ROME AIR FORCE DEPOT, Griffiss Air Force Base, Rome, N. Y.

Eastman Kodak Co., 343 State St., Rochester, N. Y., film 14" x 17", x-ray, type A safety, 400 pkg; film 34mm x 2000, MP, roll, type "R" core, 144000 ft; film, 22" x 24", commercial, speed group 12.5, (RFP 30-635-56-4472Q), $28544.

Brad Harrison Co., 4222 Warren Ave., Hillside, Ill., cable, assy-power a/w spec MIL-C-7974, 1539 ea, (IFB 30-635-56-130B), $78119.

Craig Systems, Inc., 90 Holten St., Danvers, Mass., MX1174 ( ) conduit, 6043 ea, (RFP 30-635-56-4231Q), $76746.

Pierce Wire Recorder Corp., 5900 N. Northwest Highway, Chicago 31, Ill., recorder-reproducer set, sound AN/GNQ-14, 45 ea, (IFB 30-635-56-199B), $47940.

Western Electric Co., Inc., Winston-Salem, N. C., line-RF transmission CPS-5, 195 ea; spring CPS-5, 55 ea, coupling CPS-5, 40 ea, (RFP 30-635-56-4203Q), $35837.

Radio Corp. of America, Engineering Products Div., Front & Copper Streets, Camden, N. J., H-79/AIC telephone receiver, 2000 ea, microphone-dynamic M-33/AIC, 32569 ea, (RFP 30-635-56-4190Q3, $344720.

Multi Electric Mfg. Inc., 4223 West Lake Street, Chicago 24, Illinois, light-marker, 39000 ea, blue line prints, 8 sets, (IFB 30-635-56-81B), $107305.

Roanwell Corp., 622 Pacific Street, Brooklyn 17, N. Y., headband assy H-70/AIC, H-71/AIC, H-75/AIC, 8742 ea, headset H-70A/AIC, 7962 ea, (RFP 30-635-56-4190Q), $283117.

DAYTON AIR FORCE BASE, Gentile Air Force Station, Dayton 10, Ohio

Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill., repair of direction finder sets, 1336 ea, $74820.

Radio Corp. of America, Tube Division, 19th & Federal Sts., Camden 2, N. J., 55 items of airborne search and navigation radar maintenance parts, capacitors, electron tubes, var quantities, $33589.

Western Electric Co., North Carolina Works, Chatham Road, Winston-Salem, N. C., 4 items of calls transformers, reactors, var quantities, $33728.

Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles 16, Calif., 12 items of coils and transformers, var quantities, $39009.

Micro Switch Division, Minneapolis-Honeywell Regulator Co., Freeport, Ill., 14 items of actuators and switch assys, various quantities, IFB 56-25, $47971.

Micro Switch Division, Minneapolis-Honeywell Regulator Co., Freeport, Ill., 3 items of toggle switches, various quantities, IFB 56-21, $25044.

Cutler-Hammer, Inc., 410 W. First St., Dayton, Ohio, 69 items of switches, toggle switches-tips, var quantities, IFB 56-21, $314983.

Gisholt Machine Co., 1245 Washington Ave., Madison 10, Wis., dynetric balancing machines, Gisholt Machine Co., model 3UJP, 2 ea, handbook data in a/w table IV, $85200, RFP 56-2462.

George L. Nonkervis Co., Commercial Research Division, 20 Bartkett Ave., Detroit 3, Mich., fuel nozzle test stand assemblies, 6 ea, spare parts (PR643464-1), $145370.

Raytheon Mfg. Co., Microwave and Power Tube Operations, Waltham, Mass., tube-electron, receiving klystron a/w JAN type 2K45 a/w spec MIL-E-1B dtd 2 May 52

At Your Service... Hydrospin

A few of the typical shapes of metal parts which have been Hydrospun.

Take Advantage of This Power Spinning Process and Cut Your Manufacturing Costs

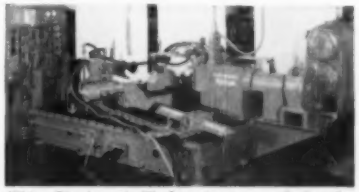
A Cincinnati Hydrospin machine is now in operation at Kaiser Metal Products, Inc., and is available to missile, jet engine and other manufacturers for development and production work.

Under high compressive forces, rollers form an inexpensive flat blank or simple preform to the shape of a rotating mandrel, usually completing a part in one pass. Movement of the roller brackets is controlled by hydraulic tracer and makes possible irregular wall thickness and curved wall shapes. Strength characteristics are improved and finish is excellent.

Savings Take Many Forms

Forming by this economical method obsoletes many chip cutting operations with resulting savings in labor, material and machines. One manufacturer has made savings of 100 lbs. of critical high temperature alloy in one jet engine part alone. Another development on a missile part shows savings of 40% in material over draw die method and saves weight of the finished part by control of wall thickness.

A wide range of metals has been successfully Hydrospun and, as the above photograph shows, an unlimited variety of tubular, conical and hemispherical shapes is possible. Ask us about ways to put this Hydrospin to work for you in solving your manufacturing problems on hard-to-make, highly stressed parts. We can show you how to produce a better part at a definite cost saving. Write for brochure today. Address Dept. A.



This Cincinnati Hydrospin, one of the few now in operation, may be the answer to your production problems.

Design Engineers: Take advantage of controlled wall thickness possible by this process and consider redesign for ultimate strength and weight savings.

KAISER METAL PRODUCTS, INC.
BRISTOL, PA.

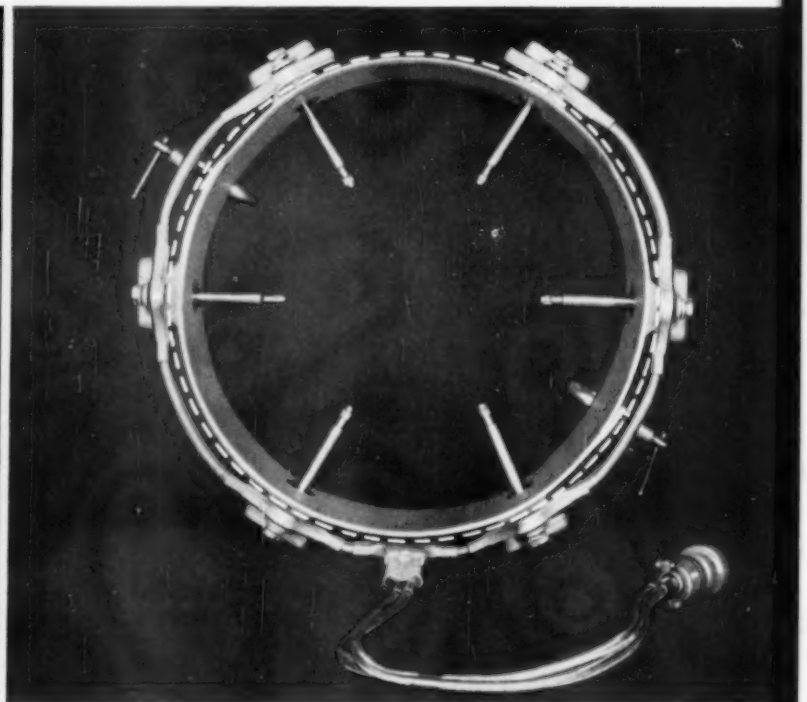
Announcing...

FENWAL'S NEW JET ENGINE HARNESS AND INTERCHANGEABLE THERMOCOUPLES, PROVIDING

- **Operation at temperatures over 1200°F**
- **Foolproof installation, simplest maintenance**

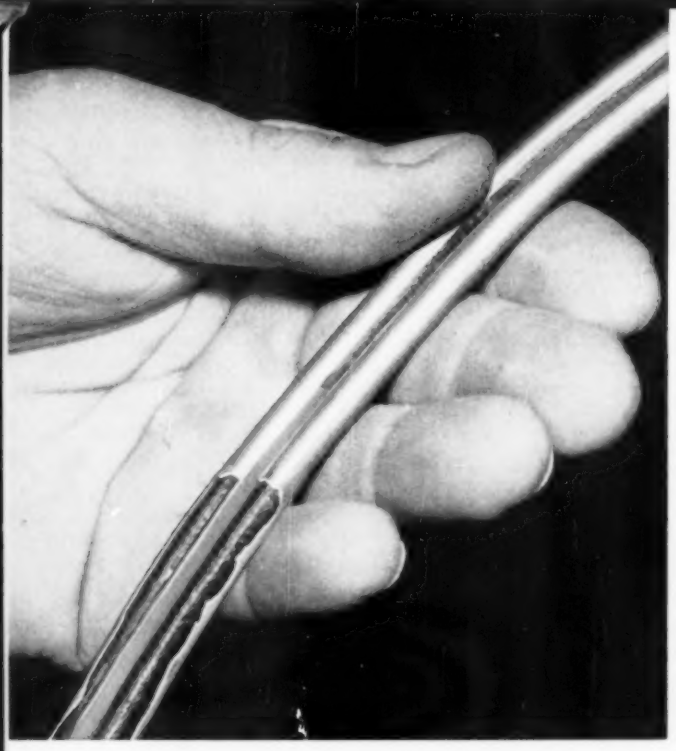
A NEW CONCEPT IN TERMINALIZATION

Fenwal's new concept of Button Terminalization for integrated assembly of thermocouples and harness allows a new ease of installation. Only two bolts — and buttons make firm, reliable electrical contact! It can actually be installed in 15 minutes by a mechanic who has never seen it before. All the thermocouples are offset — and can only be installed in one way. And should a thermocouple go bad all you have to do is remove two bolts and insert another thermocouple. And that's a great advantage in maintenance.



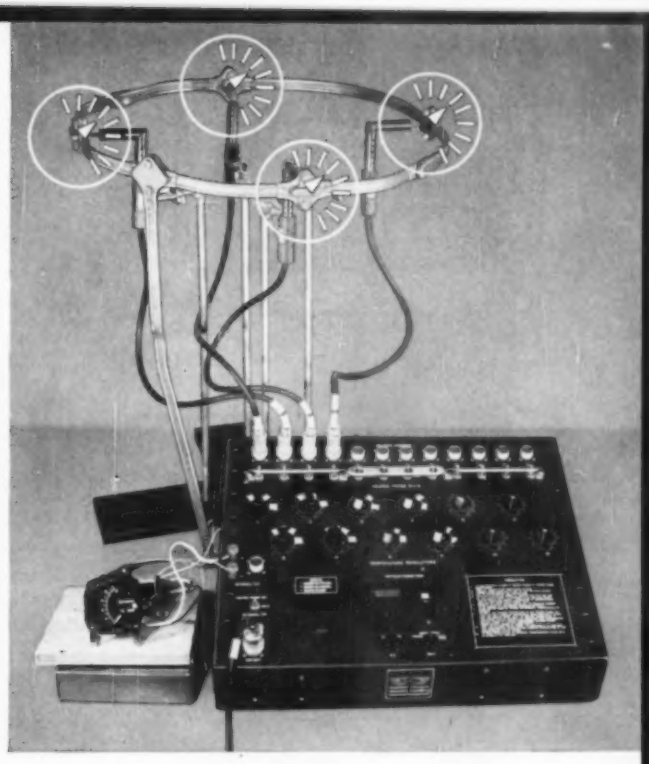
DIFFERENTIAL EXPANSION NO PROBLEM

Fenwal's new Button Terminalized harness is rigid, yet flexible enough so that differential expansion will not cause difficulties. It is so designed that even when bolted in place the harness is flexible enough so that no great stresses are placed upon the thermocouple bosses or mounting bosses for the harness. That means holding brackets do not have to be "beefed up" in order to withstand large forces due to differential expansion.



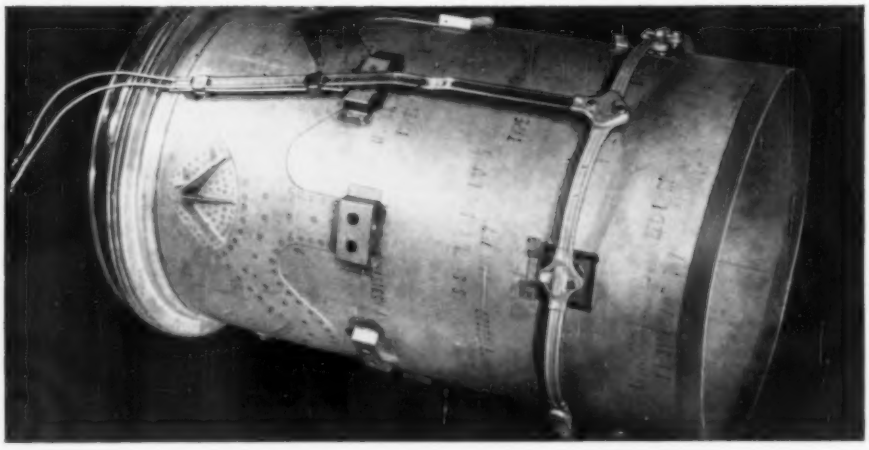
SOLID STAINLESS STEEL CASING PROTECTS WIRES

Even the wires on the Fenwal harness are encased in an insulated blanket and inserted in a stainless steel covering. This prevents the wire from becoming frayed and unraveled during installation or from vibration while in use.



BALANCED RESISTANCE HARNESS

The resistance path from each thermocouple to the indicator is equal, minimizing undesired circulating currents and enabling maximum accuracy.



ENGINE TEMPERATURE INDICATION AND/OR CONTROL

WRITE FOR ALL THE FACTS

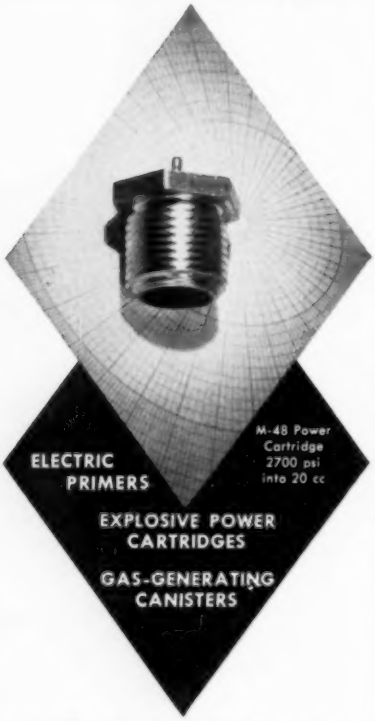
Fenwal's new concept of integrated harness and thermocouples may be of great service to you. Write for complete data now, to **Fenwal Inc., Aviation Products Division, 127 Pleasant Street, Ashland, Mass.**

Fenwal's new Button Terminalized thermocouple and harness assembly is ideal for indicating temperature. It is also used for control because of the great reliability of the Fenwal thermocouple. In fact, Fenwal thermocouples and harnesses can be used on any size gas turbine aircraft engine. They will withstand ambient temperatures over 1200°F.

Fenwal

Controls Temperature ... *Precisely*

SQUIB SPECIALISTS



An organization specializing in the design, development, and manufacture of explosive ordnance, McCormick Selph places first emphasis on dependability. The entire group is located in a 60,000-sq-ft plant on a 200-acre site having perhaps the most complete facilities of its kind in existence.

Your procurement and reliability problems in specialized explosives* can probably be solved at McCormick Selph — either with standard items, tried and proved, or with units produced to meet your specific need.

Send for data or submit your problems to:

* Ignition
Actuation
Ejection
Fracturing

McCORMICK SELPH ASSOCIATES
HOLLISTER 1, CALIFORNIA

and individual spec sheet MIL-E-1/732 dtd 17 Dec 54, 2500 ea, (IFB 56-147), $106875.

General Electric Co., Pittsfield, Mass., relay, solenoid SPDT EMN; GE part K5964840, 10 ea, relay solenoid General Electric Co. P/N 31D1279G3, 400 ea, (RFP 33-604-56-1053), $76175.

South Bend Tool & Die Co., Inc., 1916 S. Main St., South Bend, Ind., connector-receptacle, General Electric 8B92, 200 ea, connector-receptacle, General Electric 8B94, 250 ea, (RFP 33-604-56-2217), $35387.

Industrial Condenser Corp., 3243-65 N. California Ave., Chicago, Ill., capacitor-fixed paper dielectric industrial specialty 250W525, 170 ea, (RFP 33-604-56-1752), $25132.

Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio, motor-DC blower type globe P/N 3A1258, 300 ea, (RFP 33-604-56-2472), $42840.

General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C., transformer-power distributing series isolating MIL-T-7641B (ASG) dtd 28 sep 55, 50000 ea, (IFB 33-604-56-98) and Amend. No. 1, $567000.

Hupp Electronics Co., A Division of Hupp Corp., 743 Circle Ave., Forest Park, Ill., blower-propeller blade electric motor operated hupp electronic (fmly pioneer electric & research) P/N CIPM-1086-375-BL, 4000 ea, (RFP 56-2472), $63800.

General Electric Co., 225 N. Wilkinson St., Dayton, Ohio, 3 items of lamps P/N 60A21NG, 300 ea, lamps P/N 8448, 22000 ea, lamps P/N334, 26300 ea, $44058, (FSS Cont No. GS-035-17483).

Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill., switch-pressure cook elec P/N 55-975, 300 ea., switch-pressure SPDT cook elec P/N 542-1, 350 ea, maintenance data, switch-pressure SPDT cook elec, P/N 555-2031, 50 ea, switch-pressure SPST cook elec P/N 555-2188, 2000 ea, switch-pressure SPST cook elec P/N 555-2085, 200 ea, switch-pressure SPDT cook elec P/N 555-3581, 200 ea., switch-press SPST cook elec P/N 555-3429, 600 ea, switch-press SPDT cook P/N 555-119-69, 100 ea, maintenance data, switch-press cook elec P/N 555-3917, 100 ea, maintenance data, switch-press SPST cook elec P/N 555-3439, 100 ea, maintenance data, switch-press SPST cook elec P/N 555-3604, 2900 ea, maintenance data, (RFP 56-2046), $247080.

Magnevox Co., Ft. Wayne 4, Ind., coil assembly magnavox 367876-1, 2900 ea, coil assy. magnavox P/N 367878-2, 1700 ea, coil assy. magnavox P/N 367976-2, 1950 ea, (RFP 33-604-56-2355), $97838.

Cannon Electric Co., 3209 Humboldt St., Los Angeles 31, Calif., connector-receptacle AN2552-3A in a/w spec MIL-C-7974 dtd 5 nov 52 and amdt #3 dtd 22 jul 55, 20000 ea, (IFB 33-604-45-72), $83000.

LUKE AIR FORCE BASE, Glendale, Ariz.

John H. Evans & Co., P. O. Box 649, Phoenix, Ariz., construct three AN/URN-3 TACAN facilities including Type 1 building, tower foundations, fuel tanks, fuel piping, electrical primary and secondary and substations, one each complete facility at Williams Air Force Base, Luke Air Force Base, and Gila 3Bnd Auxiliary Base, Ariz., (IFB 02-604-56-43), job, $115703.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.

The Glenn L. Martin Co., Baltimore 3, Md., parts for PBM A/C, (383/2110-1993/A3/3/51), various, $58,520.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., parts for Bendix control Assy, (383/2117-205/51), various, $103,409.

The Palmer Mfg. Co., 3790 Ridge Rd., Cleveland, Ohio, Aero 23B bomb trucks, (383/29065-81S3/3/4/56), various, $193,-985.

Barber-Colman Co., Rockford, Ill., actuators, (383/2110-914/53, 383/2110-76/55), various, $26,878.

Solar Aircraft Co., 2200 Pacific Highway, San Diego, Calif., tailpipe assys, (383/2110-1989A7/3/51), 486 ea., $143,341.

Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn., servicing of propeller barrels, (MIRP 09-603-6-03A-106), 420 ea., $149,906.

North American Aviation Inc., Columbus Div., 4300 E. Fifth Ave., Columbus 16, Ohio, ground handling equip for AJ/AC, (383/2110-1902/51), var., $115,836.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicator testers, (383/29067-3S2/2/3/4/56), various, $55,905.

The Kett Tool Co., 5 E. Third St., Cincinnati 2, Ohio, universal drilling attachments, (JD-IFB-383-442-56), various, $52,-159.

Walter Kiddie & Co., Inc., 675 Main St., Belleville 9, N. J., unpainted valveless cylinders, (IFB-383-836-56), various, $29,809.

Blythe Aircraft Corp., 2201 Commonwealth Ave., Alhambra, Calif., seaplane mooring buoys, (IFB-383-860-56), various, $82,711.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts, (383/2117-207/51), various, $85,406.

General Electric Co., 1405 Locust St., Philadelphia 2, Pa., maintenance parts, (383/2120-657X6/3/52), various, $45,705.

Specialties Inc., Skunks Misery Road, Syosset L. I., N. Y., testers angle of attack & parts, (JD 383/29067-4S3/2/3/4/56), various, $284,606.

General Electric Co., 1405 Locust St., Philadelphia, Pa., drive asys for A4D-1 A/C, (383/2150-227-54), 10 ea., $93,480.

Texas Div., Bell Aircraft Corp., P. O. Box 482, Fort Worth 1, Tex., parts for HTL spares, (383/2110-2079A5/3/51), various, $34,137.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Dr., South Bend 20, Ind., maintenance parts, (383/2110-1690/52, 383/2110-844/53), var., $273,795.

R. E. Darling Co. Inc., 4858 Cordell Ave., Bethesda 14, Md., disconnect asys, for various A/C (383/2150-1504X7/3/52), 1180 ea., $62,174.

General Development Corp., Box 275, Elkton, Md., test bench harness, (JD 383/29069-42 E2/8/56), various, $68,013.

Stratos Div., Fairchild Engine & Airplane Corp., Bay Shore, L. I., N. Y., services, (383/23055-24X5/56), various, $172,949.

Metals Disentegrating Co., Inc., P. O. Box 290, Elizabeth, N. J., pigment, (IFB-383-1390-56), 72000 lbs., $42,221.

The Glidden Co., Chemicals-Pigments-Metals Div., 1717 Summer St., Hammond, Ind., pigment, (IFB-383-1390-56), 144000 lbs, $85,572.

Walter Kidde & Co., Inc., 675 Main St., Belleville 9, N. J., container, trifiorogromomethane, (383/2150-1356G4/3/52/Aero), 150 ea., $26,327.

AiResearch Mfg. Co., Div. of the Garrett Corp., 9851-9951 Sepulveda Blvd., Los Angeles 45, Calif., oil coolers, (383/2150-1627X2/4/51/Aero), 212 ea., $129,992.

Friden Calculating Machine Co., Inc., San Leandro, Calif., sights; driftmeter, (383/2120-680X6/3/52/Aero), 13 ea., $38,675.

Westinghouse Electric Corp., 3001 Walnut St., Philadelphia, Pa., maintenance parts to support Westinghouse Lima Starters, (383/2117-217/51, 383/2117-192/50), various, $151,933.

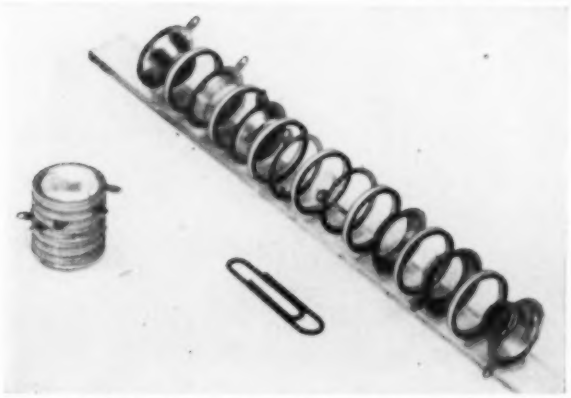
Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicators, (IFB-383-842-56), 75 ea., $38,850.

Albert & J. M. Anderson Mfg. Co., 289 "A" St., Boston 10, Mass., cable asys, (IFB-383/1206-56), 636 ea., $43,302.

NAVY DEPARTMENT, Bureau of Ordnance, Washington 25, D. C.

Western Electric Co., New York, N. Y., field modification kits for the AN/MSG-3 guided missile fire control system, NOrd-16947, $251759.

Western Electric Co., New York, N. Y., 2 sets of spare parts for the AN/MSG-3 guided missile re control system, NOrd-17033, $65652.



EIMAC 33C3A2 dual triode stacked ceramic tube in exploded view. Eimac unit is a new concept in receiving tubes.

FOUR TYPES of Eimac stacked ceramic tubes which were developed especially for new aircraft and missiles.

Tube Withstands Severe Heat, Shock

By Philip J. Klass

New York—Stacked ceramic receiving-type tubes, ideally suited for missile and aircraft use because of their ability to withstand vibration, shock, and 300-400C temperatures, are expected to be rolling off an automated production line at the rate of 50,000 per month within a year.

This was revealed here by Eitel-McCullough, San Bruno, Calif., tube maker, in a progress report on the new type tube which it developed under sponsorship of Wright Air Development Center's Electronic Components Lab (AW June 28, 1954, p. 61).

Eimac is producing pilot quantities of the new ceramic tube in two types: 33C3A2, a twin-triode equivalent of the 6SN7, and the 5C2A, a sharp cutoff pentode equivalent of the 6AK5. A beam power amplifier (CD-22) and medium-mu triode (CD-19) will soon go into pilot production.

Rugged Construction

An Eimac official revealed that the company plans to design a family of 9-12 receiving tube types which it believes will cover the bulk of military tube needs.

The Eimac tube differs radically in both appearance and construction from conventional glass tubes. It consists of a nested stack of ceramic spacers and ring-supported tube electrodes (see photo, above). The result is a structure so rigid that the tube shows no resonances under vibration up to 3,000 cycles/second, according to John McCullough, Eimac's director of research. (Conventional glass tubes suffer one or more points of resonance which adversely affects performance in aircraft-missile use.) McCullough reports the tube can take 30G shock without malperformance.

Operated at 400C

The Eimac ceramic tube has been operated at temperatures of 400C for several thousand hours without adverse failure effects, McCullough said. However, present tubes are rated for 300C temperatures.

Long tube life—perhaps up to 25,000 hours—is expected because of the unit's rugged construction, the absence of any mica (which releases contaminating gas), and the fact that the tube can be baked at extremely high temperatures prior to evacuation. With long life expectancy, Eimac has designed the tube with terminals instead of the familiar plug-in base so it can be soldered into the circuit like a resistor or capacitor.

Competitive Price

When Eimac gets into full-scale production later this year, it expects the price of the ceramic tubes to be competitive with conventional premium glass tubes built and tested to MIL-specs, perhaps even a bit cheaper. The reason is that Eimac plans to automate the manufacture, processing, and assembly of the new ceramic tubes. The company already has built machines which mechanize the key manufacturing steps, but has not yet integrated

Eimac Ceramic Tube Characteristics Listed by Designation and Type

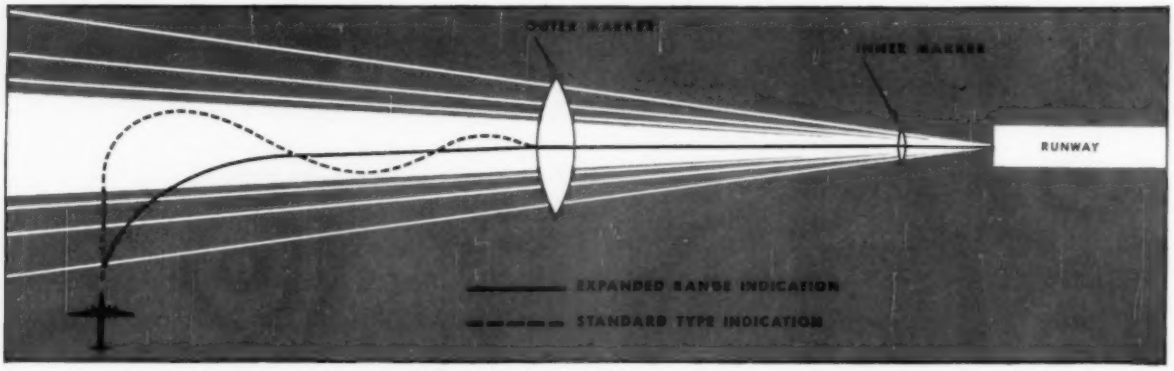
Designation:	33C3A2 (CD-16)	5C2A (CD-18)	CD-19	CD-22
Type:	Dual-Triode	Sharp cutoff Pentode	Medium-Mu Triode	Beam Power Amplifier
Heater Voltage:	6.3 v.	6.3 v.	6.3 v.	6.3 v.
Transconductance:	2,600	5,000	2,200	4,100
Amplification Factor:	20	—	17	—
Maximum Ratings:				
Plate Dissipation	2.75 w.	2.0 w.	3.8 w.	12.5 w.
Screen Dissipation	—	0.4 w.	—	2.0 w.
Plate or Total* Current	20 ma.	20 ma.*	20 ma.	75 ma.*
Plate Voltage	330 v.	200 v.	330 v.	275 v.
Interelectrode Capacitances:				
Grid to Plate	6.4 mmfd.	—	2.2 mmfd.	—
Grid to Cathode	6.9 mmfd.	—	2.8 mmfd.	—
Plate to Cathode	0.02 mmfd.	—	0.03 mmfd.	—
Feedback	—	0.004 mmfd.	—	0.005 mmfd.
Input	—	7.5 mmfd.	—	7.9 mmfd.
Output	—	2.3 mmfd.	—	2.3 mmfd.

new Bendix expanded range OMNI-MAG

...combines 3 sources of VOR/ILS flight information on a single dial

Three vital VOR/ILS instruments in one... that's the Bendix* Omni-Mag Indicator. It performs all the functions of a Relative Magnetic Heading Indicator, a Flight Path Deviation Indicator, and an Omni-Bearing Selector ... and combines the information from each on a single, easy-to-read dial.

With this 3-in-1 "pictorial" feature, the Bendix Omni-Mag has found wide acceptance in the aviation industry. Twenty-nine airlines, more than 200 executive aircraft and hundreds of military aircraft are equipped with the Omni-Mag. Now, with the addition of an Expanded Range facility, the new MN-97H Omni-Mag takes its place as the lowest cost, most versatile, reliable and easiest to use VOR/ILS instrumentation system available.



...smooths out ILS approaches... eliminates need for bracketing

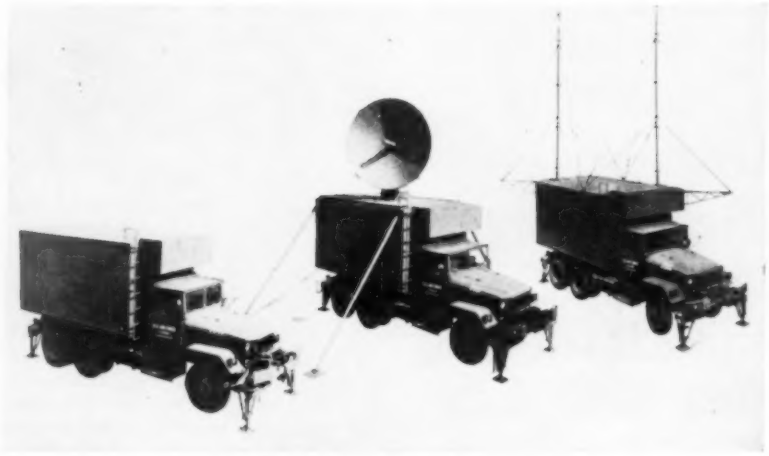
The Bendix Expanded Range Omni-Mag shows the pilot well in advance that he is approaching an ILS localizer beam. As a result, he can make a direct "close" on the beam, *without* the usual need for bracketing. By making possible more positive, quicker ILS approaches with considerably less maneuvering, the MN-97H promotes flight safety and helps reduce pilot fatigue.

For full details and specifications about this new Bendix navigation instrument, write Bendix Radio, Aviation Electronic Products, Baltimore 4, Maryland. *Reg. U.S. Pat. Off.

Bendix Radio

Bendix Radio Division • Bendix Aviation Corporation • Baltimore 4, Md.

West Coast Sales: 10500 Magnolia Blvd., North Hollywood, California
Export Sales & Service:
Bendix International Division, 205 E. 42nd St., N. Y. 17, N. Y.
Canadian Distributor: Aviation Electric, 200 Laurentian Blvd., Montreal, Que.



Close Support Control

Tactical close support control set, the MSQ-1A, consisting of air transportable truck-vans containing radar, computer, and communications equipment, can be used to guide fighter-bombers to their targets. System was designed and built for Air Force by Reeves Instrument Corp., subsidiary of Dynamics Corp. of America.

them into a fully automatic line.

(One of the objectives of the WADC development program was to redesign tubes for mechanized manufacture in order to avert a potential bottleneck in event of national emergency. Conventional tubes have a high hand-labor content.)

Although military equipment designers will be the first to use the ceramic tube, Eimac hopes to tap the radio-TV, industrial electronics market. Testing to MIL-spec procedures is a major item of tube cost. If this is eliminated and Eimac can get its production rates up to several hundred thousand tubes monthly, it believes the ceramic tube may compete in price with non-premium glass tubes.

Of interest to engineers who are designing avionic equipment for use in nuclear-powered aircraft, McCullough reports that limited tests to date indicate the ceramic tube can withstand a neutron flux density of 10^{11} per sq. cm. for a number of hours without adverse effects.

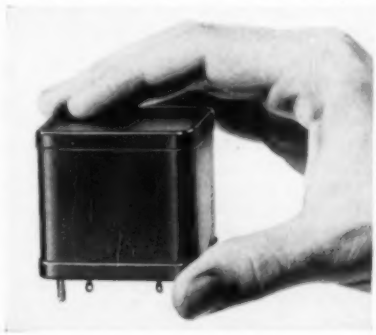
Performance characteristics for the two ceramic tubes now in production, and the two soon to follow, are shown in the table, p. 77.

NEW AVIONIC PRODUCTS

Components & Devices

• **Centrifugal blower,** available with 60 or 400 cps., 115 volts single or three phase or 24 v.d.c. motor. Typical air deliver is 60 cu. ft./min. against 4 in. S.P., when driven by a four-pole motor at 11,000 rpm. Company also announces hysteresis clutch which will handle 140 oz. in. with input power of 65 ma. at 78 v.d.c. Clutch measures $3\frac{3}{8}$ in. dia. x $4\frac{1}{2}$ in. long, has coil resistance of 1,200 ohms. American Electronics, Inc., 655 W. Washington Blvd., Los Angeles 15, Calif.

• **Transistor d.c. to d.c. converter,** converts 28 v.d.c. to higher voltage d.c., with outputs of 100 to 600 volts, powers up to 60 watts. Units can be operated over range of −55C to 80C without derating. Typical unit measures 2 x $2\frac{1}{4}$ x $1\frac{7}{8}$ in., weighs 8 oz., has efficiency of approximately 86 percent. Arnold Magnetics Co., Culver City, Calif.



• **Encapsulated potentiometer,** called "Potpot", comes in wire-wound and composition element types, in miniature and larger sizes. Water tight seal keeps moisture out of shaft bushing. Units are designed to meet environmental requirements of MIL-E-5272. Clarostat Manufacturing Co., Inc., Dover, N. H.

• **Transistorized servo amplifier,** with power gain of 100,000:1, is designed to connect directly to a size 10 servo motor

CHR NEWS

Why Douglas has first silicone rubber canopy seal

by
Bill Spencer
CHR Los Angeles

The Connecticut Hard Rubber Co.

A lot of new design and production ideas went into the Navy Douglas A4D Sky Hawk. Among them is the first silicone rubber inflatable canopy seal.

Douglas brought this inflatable canopy seal problem to us in the design stage. Replacement rate of conventional organic rubber seals was extremely high due to weathering, aging and ozone cracking, both in use and in storage. Being carrier based, A4D maintenance and spares storage had to be minimized. It was desirable to have a canopy seal with longer service and shelf life.

A silicone rubber inflatable canopy seal would answer this requirement. It would be immune to shelf aging, ozone cracking and weathering deterioration. In addition, it would inflate with the same low pressure at -65°F as at 70°F, and would not get tacky and stick or hang up when the cockpit was opened after a hot day on deck.

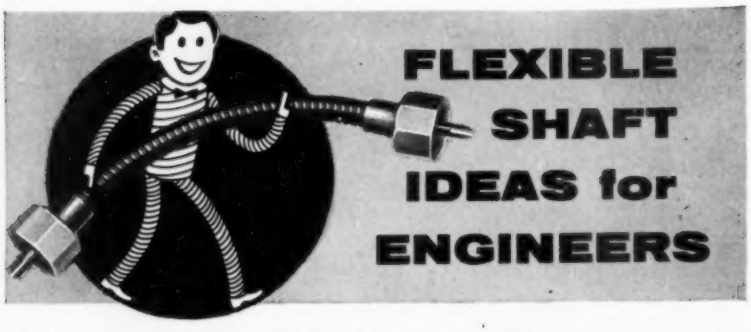
Could a silicone rubber inflatable canopy seal be made? If it could, we wanted to be the first to try.

Douglas engineers were willing to take a chance on this new design. They gave us the order. We made and qualified samples, got into production and thus helped hang one more "first" on the A4D.

Silicone rubber inflatable canopy seals are now proven out. As a result, other silicone rubber inflatable canopy seals are on order and in the design stage for the Century series, as well as new planes still in preliminary design.

SEALS • HEATERS
SILICONE RUBBER PRODUCTS
Sheet Sponge *Coated Fabrics*
Extrusions *Moldings*
THE CONNECTICUT HARD RUBBER CO.
407 East St., New Haven 9, Conn., SPruce 7-3631

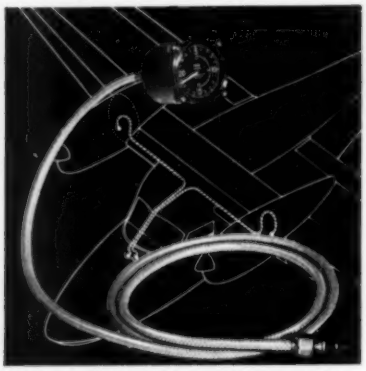
Los Angeles	St. Louis	Seattle
OLympia	TAylor	Gibson
2-0880	1-0270	1811



Gain extra design freedom... create cost-saving opportunities with S.S.White flexible shafts

S.S.White "Metal Muscles"® are readily adaptable to a wide range of space, operating and service requirements

BY USING S.S.WHITE FLEXIBLE SHAFTS to transmit power or control between two points, many of the restrictions placed on a design by rigid connections can be quickly removed.



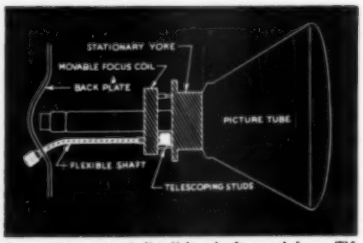
A flexible shaft tachometer drive application.

Save time and costs

Power sources and driven members or controlled parts and their controls can be positioned to better advantage. Costly methods of connection and adapting can be eliminated and general overall design can be improved. And, because an S.S.White flexible shaft does away with alignment problems and reduces the number of parts required for a control or power drive, costly and time-consuming assembly operations can be avoided.

Early consideration best

By far the best time to consider using S.S.White flexible shafts is when your product is still in the design stage. Then



A remote control flexible shaft used in a TV-focusing device.

you can use them to maximum advantage and will also have a wider selection of shaft sizes, styles and characteristics to choose from than if your design is "locked up."

Satisfaction assured

Once selected, you can always count on S.S.White flexible shafts to measure up to the requirements of your application. S.S.White's many design and manufacturing developments have made S.S.White flexible shafts first in the field for quality, performance and dependability. Experience has shown that when it comes to flexible shafts you'll always be right – if you specify "S.S.WHITE".

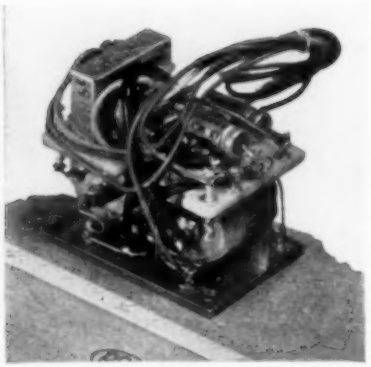
A "must" for every design engineer

Bulletin 5601 contains the latest information on flexible shafts, tells how to select and apply them. Send for your copy today.

F6-5

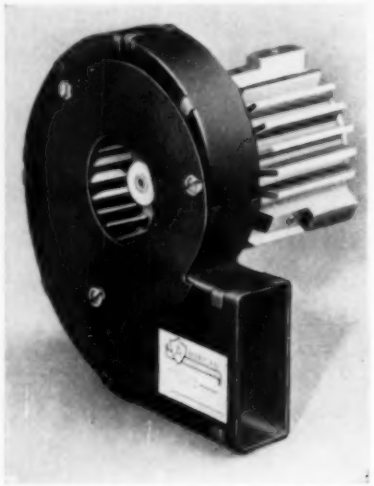
FIRST NAME IN FLEXIBLE SHAFTS

S. S. WHITE INDUSTRIAL DIVISION, DEPT. V, 10 EAST 40th ST., NEW YORK 16, N.Y.
Western Office: 1839 West Pico Blvd., Los Angeles 6, Calif.



with center-tap control winding. Amplifier is rated 1 watt at 71C, can operate down to −55C. Output stage consists of two germanium transistors operating in class "B" push-pull. Amplifier measures 1¼ x 1½ x 1 in. John Oster Manufacturing Co., Avionic Div., Racine, Wis.

• **Precision film glass resistors** are now available in greatly increased resistance. Type N is now available in one-watt sizes with resistances up to 400,000 ohms, while two watt sizes are available with

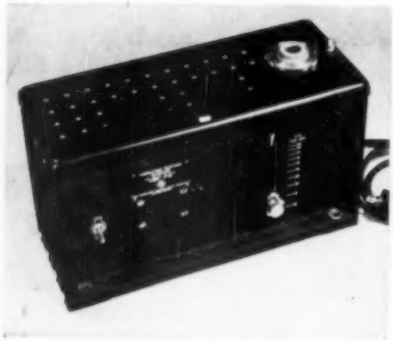


up to one megohm. Temperature coefficients have been reduced from 500 to 300 ppm/Deg. C. The power rating is based on 40C ambient and derates to zero at 140C. Corning Glass Works, Corning, N. Y.

Laboratory & Test Equipment

• **One megacycle signal source,** reportedly stable to within 1 part in 10^9 per day. Output is 4 v. rms. or 1 v. pulse. Application bulletin is available. Hycon Eastern, Inc., 75 Cambridge Parkway, Cambridge 42, Mass.

• **Vibration testing machine,** Model 14-28, can handle 5 lb. maximum load,



excite it at frequencies of 10 to 55 cps, over total excursions up to 0.08 in. in infinitely variable increments. Unit operates from 115 v.a.c., 60 cps. The Ahrendt Instrument Co., College Park, Md.

• **Power transistor test set,** Model KP1, measures all hybrid parameters in either grounded base or grounded emitter configuration over frequency range of

100 cps to 200 kc. Instrument permits reversal of emitter current, collector voltage or both to observe reverse d.c. characteristics. Baird Associates, Inc., 33 University Road, Cambridge 38, Mass.

New Avionic Bulletins

• **Precision resolvers and magnetic servo amplifiers,** specs and characteristics, in bulletins 374 and 382, respectively. Bulletin 371 gives specs and gear ratios for gearhead servo motors. Norden-Ketay Corp., 99 Park Ave., New York, N. Y.

• **Electronic standards laboratory on wheels** is described in Newsletter No. 1, Vol. 7, available from Cook Electric Co., 2700 Southport Ave., Chicago 14, Ill.

• **Radio interference-field intensity measuring equipment,** Type NM-40A for use in 30 cps to 15 kc. range. (4 pp.) Stoddart Aircraft Radio, Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif.

• **Insulated wire-wound resistors,** application data and charts. Bulletin B-5 (4 pp.) International Resistance Co., 401 No. Broad St., Philadelphia 8, Pa.

• **Tube selection chart,** for General Electric's 5-Star high-reliability line, gives characteristics and applicable military specs for 34 tube types. Ask for ETD-1276. General Electric, Tube Dept., 1 River Road, Schenectady, N. Y.

• **Transmitting potentiometer pyrometer and millivoltmeter,** Series 184A and 184E, re-

1 Resinite EP-69A VINYL INSULATION SLEEVING

SLEEVING FOR GENERAL PURPOSE and for MIL-I-631C

This *one* multi-purpose sleeving is the perfect answer for a wide range of applications. Not only is Resinite EP-69A ideal for MIL-I-631C (Grade a—general purpose and Grade b—low temperature) requirements, its low price makes it also practical for non-spec general purpose use. Using this one material for many different jobs simplifies ordering and reduces your sleeving inventory.

Resinite EP-69A exceeds MIL-I-631C Type F, Form U, Class I and II, Category 1 and 2 in both Grades a and b. It provides a working temperature range from −48°C to +90°C and a dielectric strength of 750 volts/mil. It is corrosion, fungus, oil and flame resistant. Available in all standard sizes and in 5 colors. Special colors to order.

SOFT WOUND SPOOLS assure FULL ROUND SLEEVING

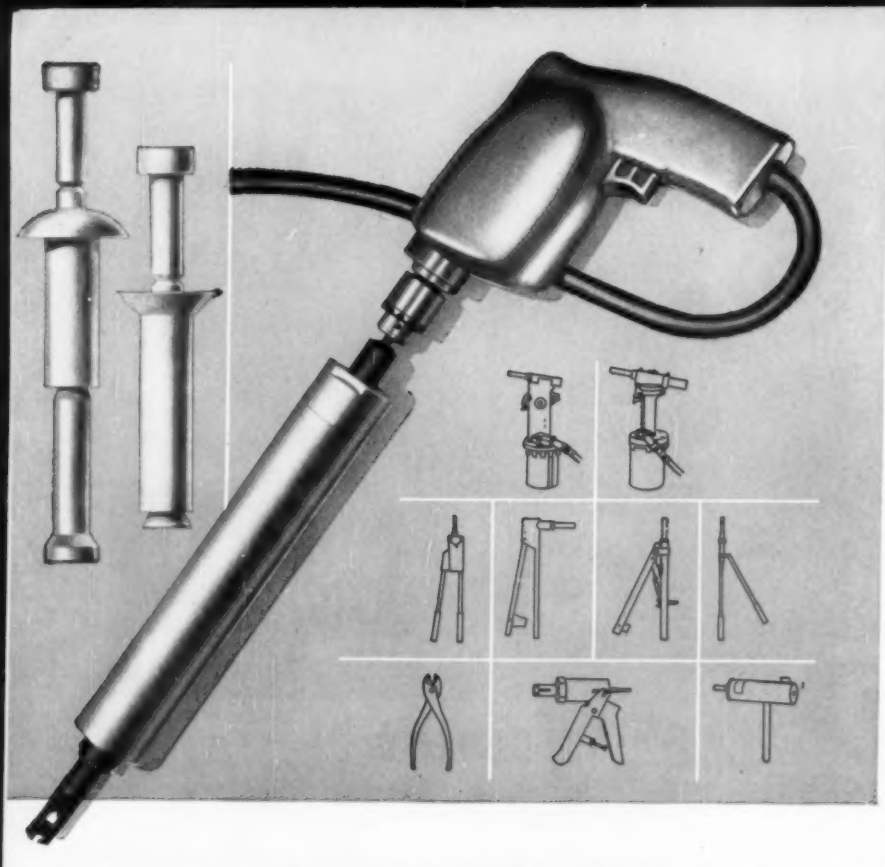
Let Resinite EP-69A simplify *your* vinyl sleeving requirements.

Write for samples and performance data now.

® Resinite

RESIN INDUSTRIES, 315 Olive Street, Santa Barbara, California
A subsidiary of The Borden Company

SPECIALISTS IN VINYL SLEEVING AND TUBING FOR THE AIRCRAFT, ELECTRONICS, ELECTRICAL AND PHARMACEUTICAL FIELDS



Another Development of Cherry Research Gives You Greater Fastening Efficiency

Newest in a long line of Cherry developments is the rivet gun shown above which will set any type or size Cherry rivet. The G-80 gun is powered by either a standard electric or air driven drill.

The versatility, positive action, ease of handling and maintenance-free service you get with this new G-80 gun will bring increased efficiency to your production lines—reduce equipment inventory—help cut unit costs.

This Cherry gun was designed and developed by the research department of the Cherry Rivet Division at Santa Ana, California, where it is also manufactured. In fact, all the tools for installing Cherry rivets are developed and produced in this plant. They are used to install a major portion of the blind rivets in use today by all industry.

In addition to developing installation tools, the Cherry research department is experimenting constantly with new designs and materials for aircraft fasteners in order to meet the greater stresses and higher temperatures imposed by ever-increasing aircraft speeds and loads.

This research recently resulted in the introduction to the aircraft industry of the new Cherry "700" rivet which has characteristics far superior to any blind rivet made previously. It provides a wide grip range, positive hole fill, high clinch, uniform stem retention and permits 100% positive inspection.

For information on Cherry rivets and the tools for installing them, write Townsend Company, Cherry Rivet Division, P.O. Box 2157-N, Santa Ana, California.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1816 • NEW BRIGHTON, PA.

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario.*

spectively. (4 pp.) Manning, Maxwell & Moore, Inc., Stratford, Conn.

• **Silicon rectifiers,** high-temperature military types. Bulletin (Four pp.) Transitron Electronic Corp., Melrose 76, Mass.

• **"Introduction to application of analog computers,"** Data File No. 121, a simplified short-course in basic theory and practice. Berkeley Division, Beckman Instruments, Inc., Dept. 541, Richmond 3, Calif.

• **Analog-to-digital encoders,** both 13 and 16-digit optical types. Bulletin (Eight pp.) Baldwin Piano Co., Electronics Div., 1809 Gilbert Ave., Cincinnati 2, Ohio.

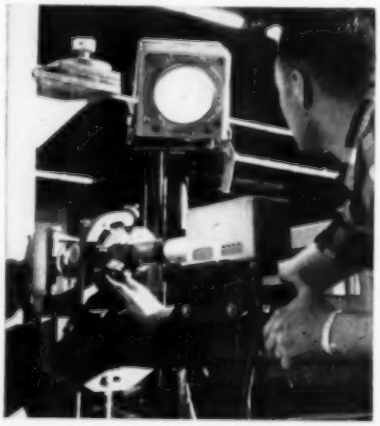
Closed Circuit TV Aids Republic Aviation

A closed-circuit television system which acts as an electronic line-of-sight is the latest improvement in Republic Aviation Corp.'s optical tooling system.

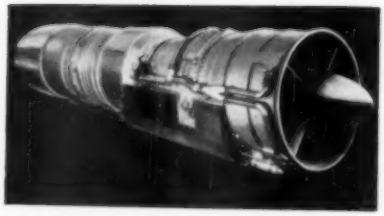
The television camera takes the place of the operator who formerly sighted through a telescope to establish a reference line and called instructions to another man who was aligning a contour plate some distance away. The TV system sees the cross-hair patterns used in jig and fixture alignment, and presents these on a screen. One operator looks at the screen and makes the adjustments in contour plate locations to align the jig pattern with the master pattern.

Republic says the accuracy is as high as the usual figures for optical tooling with human operators, and quotes figures of better than plus or minus 0.002 at 50 ft. and 0.005 at 100 ft.

Republic tool engineers under Adolph Kastelowicz, chief manufacturing engineer, worked out the TV system with officials of Telechrome, Inc., of Amityville, L. I., an industrial and color television firm. The system is



TV CAMERA sees crosshairs used in jig alignment, permits adjustment of contour plates by reference to the monitor screen rather than by original two-man method. Operator here is focusing the telescope and checking that focus on the monitor screen. Picture gives idea of the sizes of camera and monitor which are portable units. Other parts of the Republic-Telechrome system are a light source and a console.



Canadian Iroquois

First picture of Iroquois turbojet, formerly PS-13, shown here in mockup form. Engine, under development by Orenda Engines Ltd. of Toronto, will power RCAF's CF-105 interceptor. It will be test flown in B-47 loaned by USAF for the purpose. Engine has passed successfully its 54-hr. flight rating test.

made up of four units: camera, monitor, light source and console. Most of the parts are located in the console, so that the camera and monitor are portable. The camera weighs 5 lbs., the monitor 16 lbs.

Georgia's Lockheed Receives IBM Brain

What was described as the "most advanced and well-equipped" electronic brain center in the world was installed last week at the Marietta, Ga., Division of Lockheed Aircraft Corp.

The unit was installed by International Business Machines Corp.

The facility consists of two computers. One, scientifically-minded, is for use in engineering computations; the other, business-minded, is for tackling processing jobs such as payrolls, parts listing, accounts payable, inventory and production control.

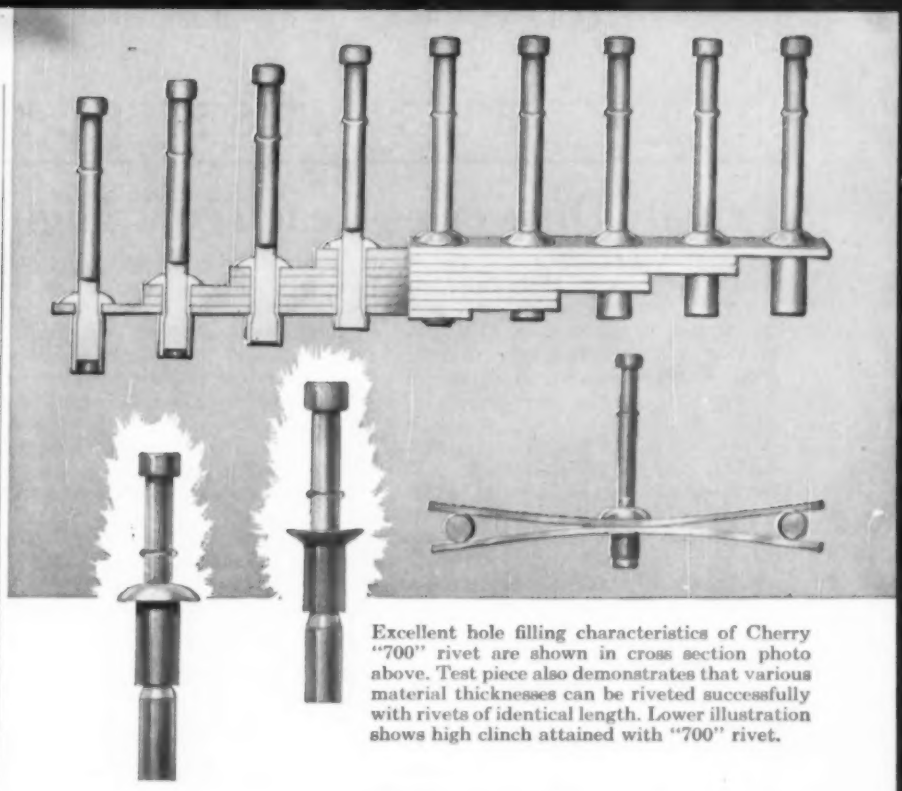
IBM said only eight similar computers are in existence. The time required for the machines to solve problems is measured in milliseconds.

Stretch Press Extends Range of Titanium Forms

Los Angeles—An hydraulically operated stretch press to contour titanium alloys is being developed by Titanium Fabricators Inc., Burbank, Calif.

The machine is expected to extend the range of titanium forming which can be done cold. It will permit forming of the metal in the narrow gap between yield and ultimate tensile strength, it is claimed. Sheets up to 30 in. wide with thicknesses up to .050 in. will be handled.

One jaw of the machine is on the die. The other jaw is connected to cables which wrap around a drum hydraulically restrained to give controlled tension.



Excellent hole filling characteristics of Cherry "700" rivet are shown in cross section photo above. Test piece also demonstrates that various material thicknesses can be riveted successfully with rivets of identical length. Lower illustration shows high clinch attained with "700" rivet.

Versatile Cherry "700" Rivet Provides New Uniform Fastening Method

The hole filling qualities, wide grip range, high clinch, and positive stem retention now possible with the new Cherry "700" rivet give the aircraft industry a uniformity of fastening never before available.

In the past, variations in hole diameter made it virtually impossible to completely fill the hole in every instance. This difficulty is eliminated with the "700" rivet which always adjusts to fill the hole and provides high stem retention.

The method of setting the "700" rivet also provides high clinch and makes it possible to use one length to fasten a wider range of material thicknesses. Positive inspection is easy since a properly set rivet is indicated by the amount of stem shoulder protruding above the rivet head.

The "700" rivet is available in countersunk and universal head styles in a wide range of diameters and lengths. It is installed with standard Cherry rivet guns with controlled-stroke pulling heads and accessories.

A product of the Cherry Research and Development Department, the "700" rivet has back of it years of fastening experience in the aircraft industry. This organization has developed the widest range of types and sizes available in the industry. Cherry engineers have designed and built special purpose machines and developed techniques that make possible such innovations as the "700" rivet.

For technical data on how the Cherry "700" rivet will give you a more uniform method of fastening, write to Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, California.

CHERRY RIVET DIVISION

SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1816 • NEW BRIGHTON, PA.

In Canada: *Parmenter & Bulloch Manufacturing Company, Ltd., Gananoque, Ontario.*

Private Deliveries Reach New High

U.S. business and utility aircraft manufacturers continued breaking their records of monthly aircraft deliveries by shipping a new high of 693 units in May at a net billing value of $10,646,672. This represents an increase of 30 airplanes over the previous high in April.

The May figures bring the totals thus far this year to 3,203 airplanes, indicating that at the present rate manufacturers will easily surpass by a wide margin last year's mark of approximately 4,500 units. Reports from the field show no slackening of customer desire for new business airplanes, pointing toward continued high production levels throughout the year, and an attendant impact on a high demand for suppliers items including powerplants, propellers, radio and navigation equipment, and a host of other products.

Predictions by the major manufacturers earlier this year that they would exceed their record-breaking business by good margins seem to be borne out by the figures when compared with the same five-month period of 1955:

• **Aero Design & Engineering Corp.** delivered 48 airplanes valued at $3,603,700 through May this year compared with 34 units valued at $2,321,000 in the same period last year.

• **Beech delivered** 333 units through May valued at $12,948,566 as against 303 billed at $10,930,000.

• **Cessna shipped** 1,584 units valued at $16,412,343 compared with 745 aircraft valued at $8,421,000.

• **Piper delivered** 1,074 aircraft billed at $10,142,887 as against 879 units valued at $7,381,000.

An important source of higher revenue for manufacturers was the increased output of twin-engine business planes. 487 left the factories through May. Of these 444 were built by four manufacturers: Aero Design, Beech, Cessna and Piper. Last year through May these builders shipped 320 twins.

Seventy three planes valued at $1,052,276 were exported by U.S. business plane builders in May, an increase of 37% over the average number of units shipped monthly last year and a 69% increase in value.

The May shipments brought the total since January, 1956, to 374 airplanes valued at $4,305,483. Manufacturers exported a total of 640 planes valued at $7,493,523 in all of 1955.

Planes delivered abroad went to 21 countries, with Canada taking the largest number, 25 units valued at $311,423. Hawaii and Alaska took an additional 11 planes valued at $113,358.

The breakdown by destination: Algeria, 2; Argentina, 1; Belgium, 1; Canada, 25; Chile, 4; Columbia, 2; Costa Rica, 2; Cuba, 1; Ecuador, 1; El Salvador, 1; Iraq, 1; Madagascar, 1; Mexico, 8; Morocco, 2; New Zealand, 2; Portugese East Africa, 1; Sweden, 2; Switzerland, 2; Union of South Africa, 8; Uruguay, 3; and Venezuela, 3.

U. S. BUSINESS & UTILITY AIRCRAFT SHIPMENTS

(January—May 1956)

	Aircraft		Builder's Net Billing Price	
	May	Jan.-Apr. Total	May	Jan.-Apr. Total
Aero Design 560-A	3	27	$984,000	$2,619,700
680	9	9		
Beech Bonanza	44	176		
Super 18	13	32		
D18S	3	3	3,116,443	9,832,123
Twin-Bonanza	12	45		
Model 45 trainer	0	5		
Callair A-5A	0	0		
A-4	3	6	15,497	23,124
Camair 480 Twin-Navion	0	9	0	235,450
Cessna 170[1]	18	43		
172	110	633		
180	34	282	3,984,893.16	13,427,450.69[2]
182	146	205		
310	22	84		
Champion 7EC	23	55	77,941.25	226,537.21
Helio H-391B Courier	3	9	69,000	208,000
Lear Learstar Mk. 1	0	3	0	1,200,000
Mooney Model 18C	1	6	93,629	171,244.65
Model 20	9	15		
Piper Super Cub PA-18	22	75		
Super Cub PA-18A	52	189	2,265,269.15	7,877,618.04
Tri-Pacer PA-22	121	433		
Apache PA-23	41	141		
Royal Gull P-136L	0	7	0	521,500
Taylorcraft Model 20	4	11	40,000	100,153.80
Totals	693	2,503	$10,646,672.56	$36,442,901.39

[1] Model 170 production discontinued because of overwhelming demand for Model 172, which is similar but has tricycle landing gear.

[2] Includes sales of five factory-owned Cessna 195s and two agricultural versions of L-19.

Source: Compiled by AVIATION WEEK. Previous tabulations for 1956: AW May 28, p. 101; AW May 7, p. 103; Apr. 2, p. 67; Mar. 19, p. 63.

ROTC Program Would Cut Washouts, NATA

Current military student pilot elimination rate of 43% could be reduced to 10% or less if flight training was introduced in current college ROTC programs, a spokesman for National Aviation Trades Assn. testified before a subcommittee of the Senate Armed Services Committee.

Edwin Lyons, vice president-training for NATA, which represents fixed base operators offering pilot training in 45 states, advocated Senate passage of the House-passed bill H.R. 5738. Under the program, U.S. Air Force would contract with local fixed base operators to supply about 35 hr. flight time in light aircraft to ROTC college students.

Lyons reviewed USAF studies that

Shipments by Plants Manufacturing Complete Civilian Aircraft and Engines for Civilian Aircraft

	April 1956	3-month moving average February, March and April	Cumulative totals January-April 1956*	Cumulative totals January-April 1955*
Complete aircraft, total airframe weight (thousands of pounds)	1,219.6	1,228.5	4,671.6	3,620.5
By weight of plane				
Under 3,000 pounds airframe weight	638.9	600.1	2,290.2	1,508.8
1,000 pounds airframe weight and over	580.7	628.4	2,381.4	2,111.7
By number of places				
1- and 2-place	575.3	542.8	2,072.8	1,348.1
3- to 5-place				
Over 5-place	644.3	685.7	2,598.8	2,272.4
By total rated horsepower, all engines				
Under 100 hp	544.6	510.6	1,944.0	1,262.6
100-399 hp				
400 hp. and over	675.0	717.9	2,727.6	2,357.9
Aircraft engines, number	949	997	3,920	2,589
Aircraft engines, total horsepower (thousands of horsepower)	431.4	421.5	1,647.7	1,276.9

	1956		April 1955*	Cumulative totals January-April	
	April	March*		1956*	1955*
Complete aircraft, number	692	656	453	2,499	1,640
By weight of plane					
Under 3,000 pounds airframe weight	661	623	440	2,386	1,551
3,000 pounds airframe weight and over	31	33	13	113	89
By number of places					
1- and 2-place	637	602	417	2,204	1,48
3- to 5-place					
Over 5-place	55	54	36	195	153
By total rated horsepower, all engines					
Under 100 hp	617	581	400	2,220	1,436
100-399 hp					
400 hp. and over	75	75	53	279	204
Value of shipments of complete aircraft and parts, total (thousands of dollars)	40,646	40,113	28,367	152,959	126,654
Aircraft, total	30,229	29,562	17,794	113,703	94,939
Under 3,000 pounds airframe weight	9,506	8,894	6,110	32,617	20,752
3,000 pounds airframe weight and over	20,723	20,668	11,684	81,086	74,187
Aircraft parts	10,417	10,551	10,573	39,256	31,715
Value of shipments of aircraft engines and parts, total (thousands of dollars)	19,906	19,157	11,341	75,644	48,774
Aircraft engines	7,967	7,600	5,169	29,290	23,599
Engine parts	11,939	11,557	6,172	46,354	25,175
Unfilled orders (number of planes 3,000 pounds airframe weight and over)	867	841	351	.....	.....

* Revised.

indicated the effectiveness of lightplane experience in military pilot training covering a cross-section of 27,210 students.

Eliminations during military training showed up thus: Students holding commercial pilots licenses, 4%; those with private pilots licenses, 5%; student pilots who had soloed, 9%; student pilots who had not soloed, 26%; those whose previous flight experience had been only as a passenger, 37%, and those who had not previously flown, 49%.

PRIVATE LINES

Experimental television program aimed at developing public interest in flying is being given a six-week trial by Piper Aircraft Corp. and several distributors. Ease of learning to fly is demonstrated by an instructor coaching a woman student in a Piper Tri-Pacer. The distributors offer listeners a half-hour's dual flight instruction for nine dollars and they are invited to bring along two friends or relatives free.

French Boisavia Anjou twin-engine lightplane has started flight tests. Powered by 170-hp. SNECMA powerplants, the Anjou carries five, including a pilot, on stage lengths of 1,100 mi.

Aero Commander franchise covering northern Ohio was granted Chamberlin Aviation, Inc., Akron, Ohio.

An 11-to-13-mph. speed increase is reported for Jones & Laughlin Steel Corp.'s Lockheed Lodestar following modification by Pacific Airmotive

This is the Honeywell capacitance fuel gage. Completely transistorized, it's smaller, more reliable, and as light as 0.8 pound per system. And like Honeywell's pioneer electron-tube gage, it's so accurate it measures any fuel load to within two percent. Honeywell, specialists in gaging of all types, has fuel measurement systems specified for more than 120 different models of aircraft.

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If you are interested in a career at Honeywell, call or send your résumé to Bruce Wood, Technical Director, Aeronautical Division, Dept. AW-7-155, 2602 Ridgway Road, Minneapolis 13.

MINNEAPOLIS Honeywell

Aeronautical Division

Poles Show the West New Aircraft

Western visitors to the recent 25th International Poznan Fair in Poland were shown several new training aircraft including an all-metal tandem trainer (left), resembling the North American T-28, and several gliders. Large-scale rioting by workers disrupted the fair.

Corp., Burbank, Calif. (AW June 18, p. 111).

First expansion of services outside of its Dallas, Tex., base has been established by Southwest Airmotive Co., which set up distributor-sales divisions in Kansas City, Kans., and Denver, Colo.

Bristol Sycamore helicopter will be used in aerial geophysics survey operations by Kenting Helicopters, Ltd., Oshawa, Ont. The helicopter will be fitted with a new electromagnetometer suspended by a cable.

Large business aircraft service center has been opened at Pompano Beach Airport by Remmert-Werner of Florida, Inc. New operation will handle planes up to Convair types and provide 24-hr. line service, maintenance and conversion facilities. Firm is building a steel and masonry hangar with openings on all four sides for servicing. Remmert-Werner now has bases at St. Louis and the new Express Airport, Toledo, Ohio.

Series D detergent aviation oil, in Grades SAE 30, 40 and 50, is being marketed to business plane operators by Gulf Oil Corp. Product has an antifoam agent.

Lear has increased the speed of the Learstar by another 15 mph. by new modifications, making the top speed 399 mph. Changes include submerging the oil coolers, adding new cylinder baffles to reduce back pressure and new propeller spinners.

Biggest aerial attack by Department of Agriculture on insect infestation will cover 2.6 million acres in New England and the Mid-West in a two-month period. More than 20,000 tons of insecticides will be sprayed over the area against gypsy moths, Mormon crickets and grasshoppers. CAA agricultural aviation specialist Gale

In Moscow

Aviation equipment manufacturer William P. Lear and wife, Moya, stand by their private plane after arrival at Vnukova Airport in Moscow June 26. Lear and his wife, plus a Russian navigator, flew from Berlin with a refueling stop at Vilna. Lear, the first Westerner legally to fly a personal plane into Moscow, was there the same time as Air Force Chief of Staff Nathan Twining and party. Plane carried a load of Lear products for inspection by Soviet officials.

Hanson will work with safety agents in these areas to check pilot qualifications, techniques and maintenance of the 75 planes which will participate.

Swissair-Revenue Increases in 1955

Swissair flew a total of 61,594,149 revenue ton-kilometers during 1955, earning a net profit of $367,693 for the year, according to the airline's annual report. Swissair carried 630,719 passengers and over 9 million ton-kilometers of cargo.

Average passenger load factor was up to 64.8% from 59% in 1954. The 1955 cargo total represented an increase of 48% over the previous year. North Atlantic traffic accounted for about a third of Swissair's total ton-kilometers flown during 1955.

USAF Tests Beech's Model 73 Jet Trainer

USAF started a test program on the Beechcraft Model 73 Jet Mentor last week to determine its suitability for a tandem-seat primary jet trainer.

Edwards Air Force Base flight test personnel will spend two weeks at Beechcraft's Wichita plant to study the plane's general flight characteristics and handling qualities.

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WHO'S WHERE

(Continued from page 23)

Dr. George L. Haller, general manager, Defense Electronics Division, General Electric Co., Syracuse, N. Y. **L. Berkley Davis**, general manager, GE's Electronics Components Division, Owensboro, Ky.

Richard W. Lee, director, Avionic Engineering Division, General Precision Laboratory, Pleasantville, N. Y. Also: **Donald S. Kellogg**, chief engineer; **William H. Heath**, assistant chief engineer; **Dr. George R. Gamertsfelder**, research director; **Otto J. Kolb**, chief product engineer and **Donald S. Basim**, chief, special planning staff.

Henry Schweibert, chief engineer, Telectronics Laboratory, Inc., Westbury, N. Y.

Clarence E. Liske, traffic and sales manager, Helicopter Air Service.

Dr. Sidney L. Simon, director of applied research, Research & Development Division, Avco Manufacturing Corp., Stratford, Conn.

A. R. Civitate, aircraft service director, Vickers, Inc., Detroit, Mich.

A. L. Paquette, sales manager, aircraft equipment dept., Westinghouse Electric Corp., Small Motor Division, Lima, Ohio.

William W. Chapman, sales manager, Aircraft Products Division, Kawneer Co., Niles, Mich.

Ernest E. Pierce, defense products manager (Dayton), American Machine & Foundry Co., New York, N. Y.

Glenn A. Evans, general manager, Marion Division, Whirlpool-Seeger Corp., Marion, Ohio.

Al Crook, chief pilot, Commodore Air Service, Sausalito, Calif.

Daryl DeVault, general superintendent-electronic maintenance, Braniff Airways.

Vernon S. Sorenson, chief process engineer, U. S. Propellers, Inc., Pasadena, Calif.

Edward V. Albert, aircraft engine specialist, Aviation and Defense Industries Sales Dept., General Electric Co., San Diego, Calif.

Stan F. Erbeck, project manager, supersonic trainer, Northrop Aircraft, Inc., Hawthorne, Calif.

W. L. Gorrell, manager, General Electric Co.'s electronic tube plant, Anniston, La.

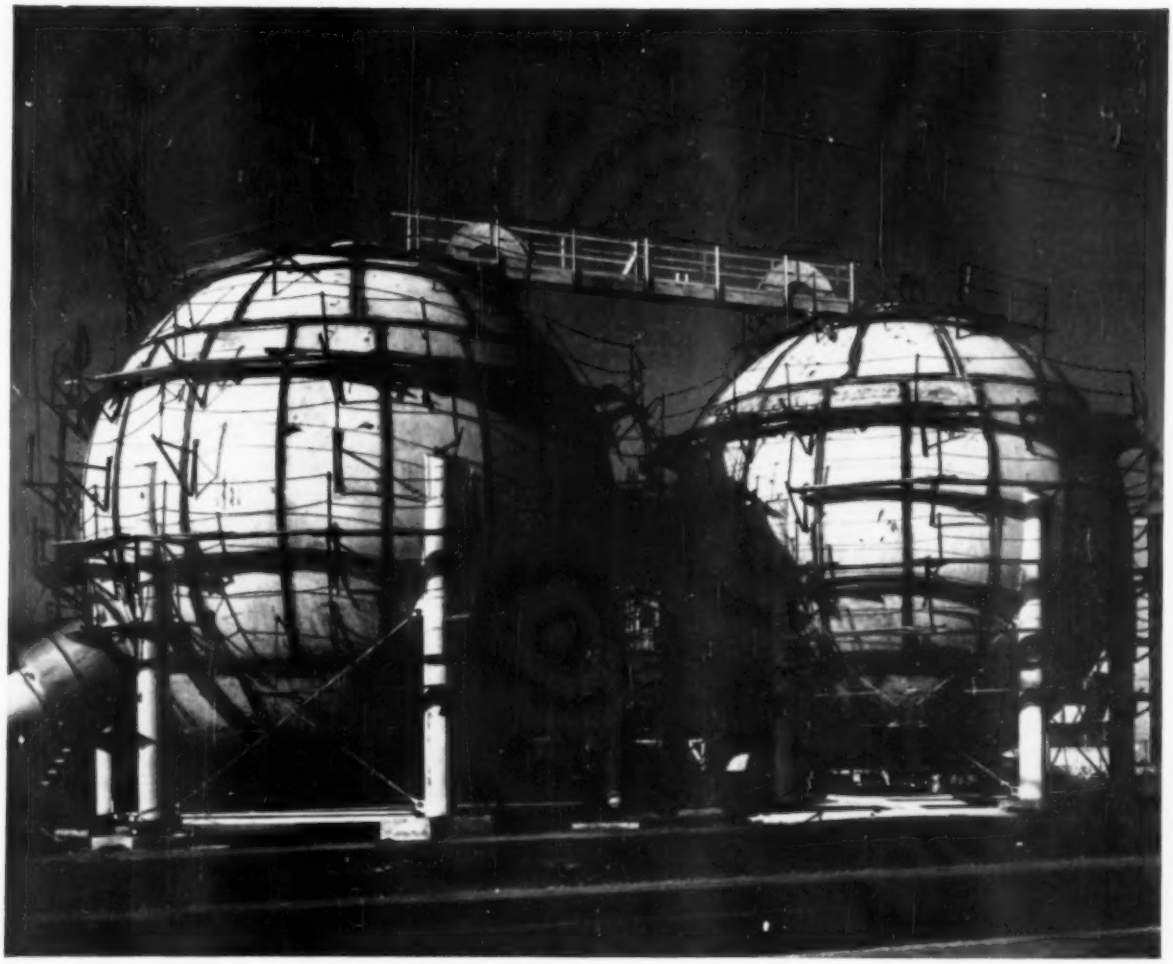
Marvin D. Weiss, manager, Analytical Division, research department, Fischer & Porter Co., Hatboro, Pa.

Philip A. Allen, Jr., manager, Aeronautical Export Corp., Miami, Fla.

Kenneth E. Fersch and **William H. Keane, Jr.**, senior sales engineers, Propeller Division, Curtiss-Wright Corp., Caldwell, N. J.

Harry L. Owens, chief engineer, Semiconductor-Components Division, Texas Instruments, Inc., Dallas, Tex. New assistant chief engineers: **Boyd Cornelison**, semiconductor products; **Charles E. Earhart**, contract projects; **John R. Pies**, resistors and transformers; **Lawrence Congdon**, meters, applications, qualifications and evaluation and automation. **Charles T. Mankus**, administrative engineer. Also **Cecil P. Dotson**, manufacturing manager; **Robert W. Bronson**, production manager.

Joseph A. Mathews, manager, Potentiometer Division, Chicago Aerial Industries, Melrose Park, Ill.



Boeing's new Mach 4 tunnel: a vital step in the engineering art

Typical of Boeing's superb facilities, this new supersonic wind tunnel will lead to important engineering advances. It is capable of producing velocities four times the speed of sound, and will be teamed with Boeing's present transonic tunnel for a research facility that will be the most advanced and versatile of its kind in private industry. The new tunnel will be in operation very shortly.

Mechanical and civil engineers will be able to test new structural components and materials under the extreme conditions of hypersonic flight. Electrical engineers will develop new techniques in instrumentation, and try out new ideas in radome configuration design and many other fields. Aeronautical engineers will be able to study the behavior of aircraft and guided missiles in high-speed flight.

In addition to the new tunnel, engineers find other advanced facilities at Boeing: the latest electronic computers, a chamber that can simulate altitudes up to 100,000 feet, a new multi-million-dollar Flight Test Center, and many more. This is evidence of Boeing's steady growth. The company now employs more than twice as many engineers than at the peak of World War II—and more engineers are needed.

Engineers who come to Boeing will find stimulating work, at the very frontiers of engineering knowledge. They will find individual recognition and opportunity for advancement in small, tightly integrated "teams" in research, design or production. And they and their families will enjoy living in the pleasant and progressive community of Seattle or Wichita. There may be a place for *you* in this challenging world of tomorrow at Boeing-Seattle or Boeing-Wichita. Won't you write and find out today?

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Here's how this new "Maximizer" works: A newly-designed, completely integrated system of engine cowling, engine baffles, oil cooler ducting, wheel well doors and tail wheel well closure, and exhaust system is installed.

Each of these modernizing improvements acts to reduce drag. Single engine rate of climb is greatly improved, fuel consumption decreased, range increased, payload improved...and cruising speed is raised a guaranteed 20 miles per hour!

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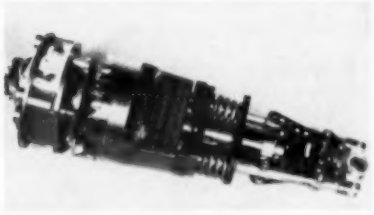
NEW AVIATION PRODUCTS

Bellows Tie-Rod Assemblies

Two types of stainless steel bellows tie-rod assemblies for use in jet engine pneumatic ducting systems are available in diameters from one-inch to 15 in. The center link or single-pivot type anchors the end of the bellows at a single point along the bellows center line. The double-pivot or double-link type has two pivots on the bellows' center line to anchor the ends and is capable of absorbing some lateral effect.

Metal Products Manufacturing Division, Arrowhead Rubber Co., Long Beach, Calif.



Surface Pulser for Missiles

Hi-directional step functions on any of the control surfaces of a test missile are imposed by a surface pulser using 50 22-cal. blank cartridges firing alternately into a pair of opposed cylinders. Pistons convert gas pressure into rotary motion through linkage.

Amplitude, duration and time spacing of the square wave pulses can be adjusted. A hinge moment of 250 in.-lb. at 20-deg. deflection using .22 short blanks. Higher values are available with .22 long or long rifle blanks. Unit's overall length is 12.5 in. x 3⅞ in.

Hanson-Gorrill-Brian, Inc., 85 Hazel St., Glen Cove, N. Y.

Lightweight Refrigerator

A new, light-weight aircraft galley refrigerator is gaining acceptance with airlines and airframe manufacturers. Called "Aero-Kool", the unit can drop from 90F to 25F in 90 minutes. A typical 7 cu./ft. Aero-Kool unit weighs 135 lb. and draws 8 amps. at 28 v. Among purchasers are Northwest Orient Airlines, Trans World Airlines Canadian Pacific Airlines, Lockheed Aircraft Corp. and Convair.

Nordskog Co., Inc., 16000 Strathern St., Van Nuys, Calif.

Tubeless Power Source

Dual - magnetic - regulated airborne power source provides transient-free five-volt d.c. for missile and aircraft instrumentation. The unit is designed to operate up to 60,000 ft., high-altitude efficiency. This is accomplished through use of a 2306-33 Cannon connector which permits the MRP-5-1S to carry 11 v. a.c. at that altitude.

Magnetic flux oscillator circuitry isolates line voltage transients from the output and regulates d.c. to 0.1% accuracy, the maker reports. The equipment is said to be short-circuit proof, has no tubes and requires no batteries or fusing. It hermetically sealed in thermosetting plastic and meets MIL-T-27 and MIL-E-5272A. Silicon diodes provide stable operation at 100 C.

Magnetic Research Corp., El Sagundo, Calif.

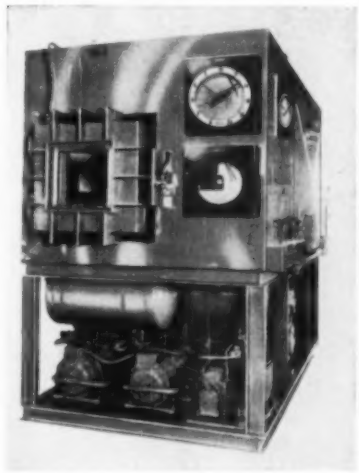
Filter for Cabin Pressure Units

A new cartridge filter for AiResearch cabin pressure regulating equipment has shown a life of 3,000 hr. in research tests with no contamination reported to the regulator. The manufacturer of the regulating equipment normally recommends a change of filter after every 1,000 flying hours.

Shorter down-time is also reported when using the new filter: usually it takes about six hours to clean the pressure regulator control head, the filter can be changed in minutes.

The assembly comprises an AiResearch-designed housing unit, an MSA cartridge-type filter element, nipple and flange.

Mine Safety Appliances Co., Pittsburgh 19, Pa.



Test Chamber Simulates 150,000 Ft.

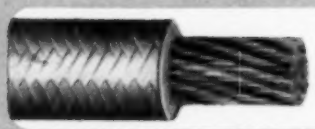
Designed specifically to a request by Canadian Westinghouse engineers for a large environmental equipment test chamber capable of simulating 150,000-ft. altitudes, this unit features automatic temperature control from −100F to +250F. Humidity can be controlled from 20 to 95%.

Webber Manufacturing Co., Inc., 2740 Madison Ave., Indianapolis, Ind.

Flight Control Servo Valve

A stabilization and flight control servo valve that uses dry coil construction has an isolation diaphram that

specify **LEWIS**
high temperature and
moisture resistant
aircraft electrical cable
for critical circuits
to MIL-C-25038



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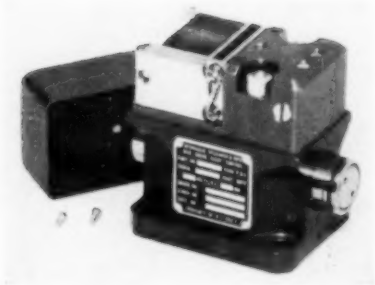
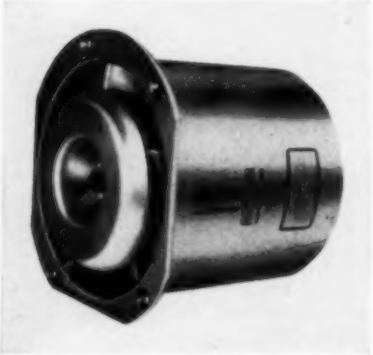


functions as a positive fluid barrier. Coil and all magnetic circuitry operate in air rather than fluid media, preventing contamination by buildup of magnetic particles. Five internal micronic corrosion resistant steel filters are used to handle oil flows through the valve. All oil that passes through the hydraulic amplifier section must go through three separate filtering stages.

Hydraulic Research & Manufacturing Co., subsidiary of Bell Aircraft Corp., 2835 N. Naomi St., Burbank, Calif.



Airborne Fan Blower

Fan-blower unit for airborne applications compensates for low air density by increasing blower speeds. Unit provides 210 cfm. at two inches back pressure at 8,000 ft.; at 60,000 ft., blower speed goes to 11,000 rpm.

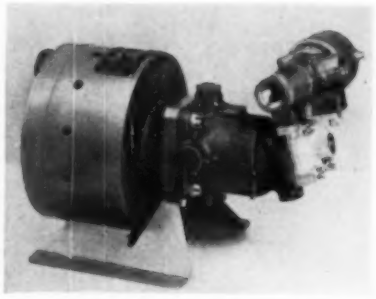
Vaneaxial fan is used. The one-sixth horsepower a.c. motor operates at 115 v., 2.5 amp., 400 cycles. Designated Model BC 2914 F-1, the blower is also available with a d.c motor.

Induction Motors Corp., 570 Main St., Westbury, N. Y.

Electric Power Packs

A line of hydraulic-powered electrical power packages for aircraft consist of a 400-cycle-type a.c. generator driven directly by a flange-mounted constant-speed oil-hydraulic motor. The motor is powered by flow available in the aircraft's existing hydraulic system.

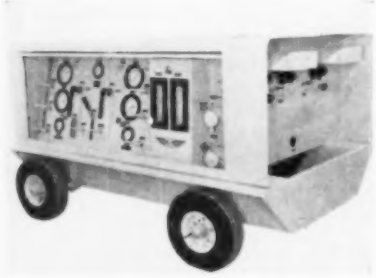
Applications for the units includes



powering of co-pilot instrumentation in multi-engine aircraft or supplying controlled-frequency a.c. power in emergencies.

Speed control is within ± 2¼% regardless of load. Special configurations will maintain 400 cps. frequency within ± 0.1% regardless of load. Units are currently available in six sizes for 0.5 to 3-kva. output. Weight ranges from seven to 19 lb.

Vickers, Inc., Box 302, Detroit 32, Mich.



Dual Hydraulic Test Stand

Dual hydraulic portable test stand Model Z828 checks out airplane systems on the flight line. Two separate and complete systems in the unit may be used together or separately.

Each system contains a 20-gpm., 5,000-psi. hydraulic pump with its own flowmeters, by-pass, volume and pressure controls and air-to-oil coolers. There is an extra supply of 10,000 psi. hydraulic pressures for static testing and 600-psi. air pressure for pressurizing plane reservoirs.

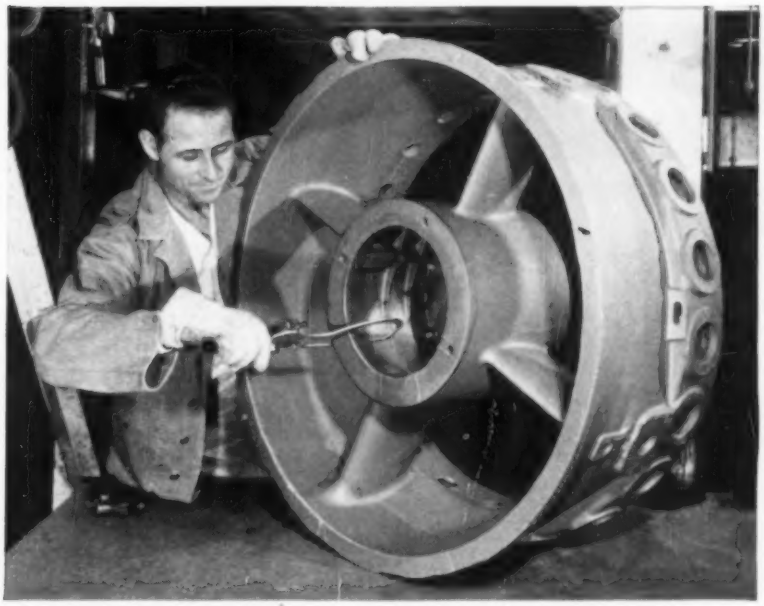
Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

Generator Replacement

Designed on the basis of a projection of aircraft a.c. power requirements of the future—including nuclear-powered types—a 160-kva. generator, designated the G180, is being studied by multi-engine plane manufacturers as a replacement for the present smaller multi-generator installations.

Prime benefit of the new unit would be the elimination of components and complexity inherent to multi installations, resulting in considerable weight

QUALITY MAGNESIUM CASTINGS



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PERMANENT MOLD CASTINGS

PLASTER CASTINGS

YOU NAME THE CASTING, Dow can supply you with any shape or size required. Specialized inspection techniques rigidly maintain your standards and specifications. Heavy-wall or thin-wall, the best—and surest—answer to your problems are Dow magnesium castings! Contact your nearest Dow sales office for additional information.

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Foundry Sales, Bay City, Michigan

DOW

savings. Ground power carts, airborne auxiliary power units and laboratory applications are also possible. Unit was developed at the request of BuAer.

Jack & Heintz, Inc., 17600 Broadway, Cleveland 1, Ohio.

ALSO ON THE MARKET

Permanent magnet motors, Type BYLM, have a centrifugal blower for dissipating heat generated by electronic tubes, circuit components and similar equipment in confined enclosures. Units are available with clockwise or counterclockwise rotation in several sizes.—Barber-Colman Co., Aircraft Controls Division, 1400 Rock St., Rockford, Ill.

Miniature Teflon coaxial cables, Types K-256, K-257, K-258, for plane and missile application are one-quarter outside diameter of comparable RG types, yet provide same impedance characteristics. Impedance ranges are 50, 70 and 93 ohms. They can operate in 150C environment. Manufacturer can also supply Type SP-132 four-conductor cables for missile motors and electronic controls. Cable has a maximum outside diameter of 0.275 in.—Federal Telephone & Radio Co., Division of International Telephone & Telegraph Corp., 100 Kingland Rd., Clifton, N. J.

Self-lock spline-type nut for use with aluminum and magnesium alloys is designed for blind mounting. Unit features a counterbored shank to take AN thread-length bolts. Type ND2398 meets AN-N-5 or MIL-N-25027 (ASG) requirements. Available in thread sizes 10-32, ¼-28, 5/16-24, ⅜-24, 7/16-20 and ½-20.—Elastic Stop Nut Corporation of America, Union, N. J.

Flexloc self-lock nuts, made of silver-plated AMS 5735 stainless steel, are designed for use at up to 1,200F. Designated 119FW, external wrench 12-point design is for application in jet engine manifolds, afterburners and similar hot areas. Available in standard sizes from No. 10 through ½-in. diameter.—Standard Pressed Steel Co., Jenkintown, Pa.

Self-contained storage oscilloscope, with infinite information persistence presents all stored waveforms at equal and constant brightness until intentionally erased. Model 102 Memoscope uses electronically regulated d.c. voltages including three and five kilovolt high-voltage supplies.—Advanced Electro Electronics Manufacturing Co., 2025 Pontius Ave., Los Angeles 25, Calif.

Tankite, for lining aircraft fuel tanks, has also been found useful as a leak preventive. Films are applied from an emulsion eliminating toxic solvents and

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fire hazard during application.—Industrial Finishes Division, H. B. Davis Co., Bush & Severn Sts., Baltimore 30, Md.

Quick-dump flow control valves for use in original equipment, as well as applications requiring manual or automatic valving of air, water, oil or Freon. Seven models are available: solenoid, cam-operated, palm button, finger-tip, foot operated and two hand lever types.—Humphrey Products, subsidiary of General Gas Light Co., Kalamazoo, Mich.

Microtrol type 150 automatic grinder control, gages workpiece diameter continuously during grinding and uses information to control final size of workpiece. Unit can be installed on either new or existing grinders; it is for true diameter gaging on center-type grinders, with three-point grinder control and wheelguard-type mounting for gaging caliper.—Industrial Products Dept., Airborne Instruments Laboratory, 160 Old Country Rd., Mineola, N. Y.

Model 9200 fractional horsepower induction motor, a sleeve-bearing unit, features an open, self-ventilated frame for cool operation. It is available for pad mounting, resilient ring mounting or end mounting.—Howard Industries, Inc., 1760 State St., Racine, Wis.

Strip burner, for hot forming titanium sheet and plate, is built in any length and shape. Other features: no cold spots at ends of sections; water cooler; fueled with air or oxygen and natural or liquefied gas; heat range instantly adjustable.—W. C. Cheney Manufacturing Co., P. O. Box 3591, Seattle 24, Wash.

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Characteristics, properties and sizes of five grades **of Ampco-Trode electronics,** AC and DC; Phos-Trode; Ampco-Trode filler rod and coiled wire and Ampco-Braz #1 and ##, applications bulletin W-25a, Ampco Metal, Inc., 1745 South 38 St., Milwaukee, Wis. . . . Specifications, data and resistance qualities of **silicone rubber products** and silicone coated cloths, brochure, Raybestos-Manhattan, Inc., Passaic, N. J.

Plans and specifications of (Boeing-Blackstone) **vane type air deflecting fence,** brochure, Blackstone Manufacturing Co., Inc., 4600 West Harrison St., Chicago 44, Ill. . . . Technical data and operating characteristics of **photographic instrumentation systems,** Triad Corp., 4515 Sepulveda Blvd., Sherman Oaks, Calif. . . . Outline of physical and chemical properties and applica-

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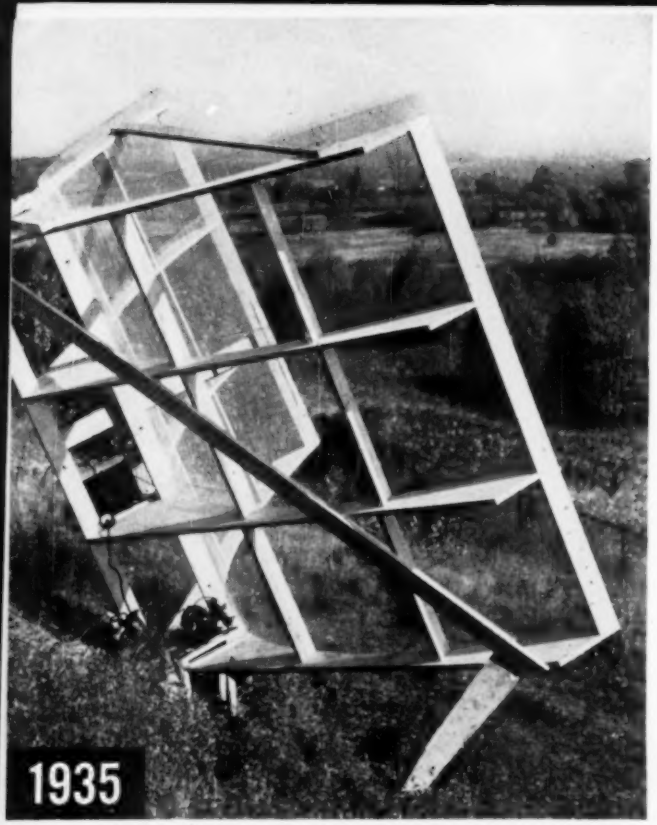

EARLY RESEARCH AND DEVELOPMENT EXPERIENCE with electronic location equipment at G.E. began in 1935 when this first system, with an output of 1½ watts, located planes up to five miles away.

IN USE TODAY, this huge nodding height finder was designed and developed by General Electric to be used with powerful search radar systems and is a major contribution to long-range aircraft location.

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tions of available **Disogrin compounds,** brochure, Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.

General principles of **torque tools and methods of use,** manual (second edition), P. A. Sturtevant Co., Addison, Ill. . . . Illustrations, dimensions, methods of fabrication and applications of **shock and vibration mountings,** Industrial Bulletin #1000, Robinson Aviation, Inc., Teterboro, N. J. . . . **Principles of operation** and available head styles, diameters and lengths of "700" rivets, bulletin TCL-112, Townsend Co., Cherry Rivet Division, P. O. Box 2156-Z, Santa Ana, Calif.

Safety breathing equipment for higher altitudes, brochure, Scott Aviation Corp., Erie St., Lancaster, N. Y. . . . Illustrations, ratings, dimensions and specifications of **switches and accessories,** catalog, Carling Electric, Inc., West Hartford, Conn. . . . Designer's guide for electric resistance welding, Bulletin 331, Sciaky Bros., Inc., 4915 West 67th St., Chicago, Ill. . . . Illustrated **information and application stories** on electronic gear packaged with plug-in components, bulletin, Alden Products Co., 117 North Main St., Brockton 64, Mass.

Applications, photographs charts and cross-section drawings of **belt-driven tube axial fans,** bulletin, Propellair Division, Robbins & Myers, Inc., Springfield, Ohio. . . . Description and features of **fractional horsepower d-c permanent magnet motors,** catalog F 4344-3, Barber-Colman Co., Aircraft Controls Division, 1400 Rock St., Rockford, Ill. . . . Information, specifications and applications on Teflon products, catalog T-55, Continental-Diamond Fibre Division, Budd Co., Inc., Newark, Del.

Publications Received

• *Protective Shot Peening of Propellers. Part I—Residual Peening Stresses* —by R. F. Brodrick, Lesells and Associates, Inc., for Wright Air Development Center, U. S. Air Force. $5.00; 438 pp. (Order PB 111802 from OTS, U. S. Department of Commerce, Washington 25.)

Investigation of the benefits of shot peening as a means of protecting aircraft propeller blades against the reduction of fatigue strength arising from surface damage.

• *Emergency Escape Procedures*—by B. G. King, R. Ostrich, and M. C. Richardson, Air Force Cambridge Research Center—$2.50; 95 pp. (Order PB 121105 from OTS, U. S. Depart-

CASE HISTORY 1

REQUIRED:
A dependable supply of this small, machined electrode to meet customer's quality and quantity needs at reduced cost.

HASSALL SOLUTION:
Hassall-designed re-heading process, involving no critical dimension changes, resulted in a 59% cost reduction to customer.

CASE HISTORY 106

REQUIRED:
Replacement for stud with insufficient head to act as stop for automatic hammering.

HASSALL SOLUTION:
Substitution of Hassall cold-headed collar nail with annular threads for greater holding power. Substantial cost savings.

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Multiply these case histories a thousandfold and you'll get some idea of the variety of tough problems we crack, and the savings we effect for our customers in the course of a year.

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CASE HISTORY 64

REQUIRED:
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HASSALL SOLUTION:
The Hassall cold-heading process plus engineering skill overcame the difficulties presented by these alloys at considerable savings.

CASE HISTORY 37

REQUIRED:
Bumper bolt with bonded rubber cap for license plate support.

HASSALL SOLUTION:
The large head on this bolt would ordinarily call for screw machining but the two lugs under the head ruled this out. Progressive cold-heading was Hassall's answer.

HASSALL

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In keeping with its plan of rotation, the U. S. Department of Defense has designated Oklahoma City the site of this year's aviation classic—the National Aircraft Show.

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Spacious hangars for indoor displays and vast outdoor exhibit areas offer airframe, engine and component parts manufacturers a singular opportunity to effectively present their latest developments to all the Services, the industry and public . . . for this is aviation's traditional annual rendezvous. It merits your serious consideration and active participation.

For floor plan diagrams, exhibit space contracts, ticket information and complete details write—Benjamin T. Franklin, General Manager, NATIONAL AIRCRAFT SHOW, 400 UNION COMMERCE BLDG., CLEVELAND 14, OHIO

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ment of Commerce, Washington 25.)

Knowledge gained from joint studies conducted by the Military Air Transport Service, U. S. Air Force and the Civil Aeronautics Administration on operational emergencies and tests on escape of personnel from aircraft following simulated landing emergencies is brought together in this manual. The several sections contain material on crew training for this type of emergency, recommended procedures, evacuation devices and equipment, and an evaluation of emergency exit provisions.

• *Supervisors Safety Manual*—Written by staff engineers of the National Safety Council, 425 North Michigan Ave., Chicago 11, Ill. Price to Council members, $3.25; price to non-members, double; other prices if ordered in quantity. 354 pp.

Written to provide foremen with a comprehensive guide to all phases of industrial safety, the manual includes material on the human side of safety, maintaining interest in accident prevention, first aid, protective equipment, housekeeping, materials handling, machine guarding, portable power tools and fire prevention.

• *Addresses Presented at the Sixth National Conference on Standards*—Available from the American Standards Association, 70 East 45th Street, New York 17, N. Y. $3.00; 94 pp., 8 photographs.

Thirty addresses given at the Sixth National Conference on Standards, Washington, D. C., in October, 1955, on the general topic of the effectiveness of standards in saving money and increasing efficiency. Speakers include Assistant Secretary of Defense Thomas P. Pike and the airplane engine industry's C. E. Mines.

• *Proceedings of the Gas Dynamics Symposium* on the theme Aerothermochemistry—Held at The Technological Institute, Northwestern University, Evanston, Ill., August 1955. $4.00; Approx. 250 pp; bound.

Contains 25 original research papers on turbulent combustion, flame stabilization, detonation, and thermodynamics, laminar flames, and the combustion of condensed phases.

• *Atomic Energy*—Pub. by the Academy of Sciences of the U.S.S.R. — Translated by Associated Technical Services, P. O. Box 271, East Orange, N. J. Six issues per year, available on annual subscription at the rate of $85.00. Subscriptions and inquiries should be forwarded directly to A.S.T.

This Soviet journal will publish articles and reviews of latest achievements related to peaceful uses of atomic energy.

CAB Accident Investigation Report:

Eastern Flight Crashes Off Runway End

An Eastern Air Lines Martin 404, N 487A, Flight 175, was damaged extensively when it overran the Tri-State Airport, Huntington, W. Va., at approximately 1850[1] on Jan. 15, 1956. No injuries resulted to either crew or passengers, and no fire occurred.

Flight 175 originated at Chicago, Ill., for Charlotte, N. C., via intermediate stops including Louisville, Ky., and Huntington. Captain Robert C. Moore, Pilot James L. Lane, and Flight Attendant Dolores D. Pauls comprised the crew. The flight was routine to Louisville where a landing was made at 1731.

At Louisville the aircraft was serviced and at the time of departure carried 680 gallons of fuel and 32 passengers for a gross takeoff weight of 42,913 pounds. (Maximum allowable was 44,900 pounds.) The center of gravity was within prescribed limits. The crew was given the latest Huntington, Charleston, and Greensboro weather and the flight departed Louisville ramp on schedule at 1750 on a VFR flight plan, estimating 51 minutes to Huntington.

Captain Moore made the takeoff and flew the entire Louisville-Huntington segment. En route the flight requested and received an IFR clearance, via V-4 Airway to cruise at 5,000 feet, and was given the latest Huntington weather. This indicated the ceiling to be 1,000 feet, visibility 1 mile, wind calm, light snow, and that braking action was "poor" on the snow-covered runway.

Charleston approach control[2] cleared the flight for an approach to Tri-State Airport at Huntington. The aircraft crossed the end of runway 30 at an estimated speed of 90-95 knots at an altitude of 50-100 feet and passed over almost one-half the length of the 4,600-foot runway before touching down. The crew was not able to stop within the confines of the airport and the aircraft nosed slowly over the brink of a slope approximately 100 feet beyond the end of the runway.

[1] All times herein are Eastern Standard and based on the 24-hour clock; all airspeeds are in knots; and all distances are in nautical miles (except visibilities which are in statute miles).

[2] Charleston approach control normally handles IFR air carrier traffic for Huntington.

INVESTIGATION

The dispatch release for this flight out of Louisville listed Charleston as alternate for Huntington, and Huntington as alternate for Charleston. This was changed at 1735 listing Roanoke as alternate for Charleston, but retaining Charleston as alternate for Huntington.

The Huntington, Charleston, and Greensboro weather given the crew was as follows: Huntington—Precipitation ceiling 1,500, obscuration; visibility ¾ mile; light snow showers; smoke; temperature 29; dewpoint 26; wind calm. Charleston—6,000 scattered, estimated 9,000 overcast; visibility 1 mile; smoke; temperature 33; dewpoint 30; wind west-southwest 5. Greensboro—16,000 scattered, estimated 30,000 overcast; visibility 12 miles; temperature 54; dewpoint 2; wind southwest 6; breaks in the overcast.

The flight reported as being over the Lexington VOR station at 1813 at 5,000 feet to the company radio at Louisville, and requested and received an IFR clearance to Huntington. The flight reported to Charleston approach control over Bruin Intersection at 1833 at 5,000 feet and was cleared via Wayne Intersection direct to the Huntington marker to maintain 5,000 feet, and to report passing Wayne.

Weather Transmitted

Charleston approach control then transmitted to the flight the latest Tri-State Airport weather conditions as furnished by the company: "Precipitation ceiling 1,000 sky obscured; visibility 1; light snow; temperature 28; dewpoint 24."

At 1835 Huntington company radio advised the flight directly, "We have about an inch or inch and a half of snow; we have no outgoing passengers, and braking conditions on the runway are poor."

At 1836 Flight 175 was also advised by company radio of the altimeter settings, calm wind conditions favoring runway 30, no traffic, and Huntington 1830 weather: "Precipitation ceiling 1,000 feet, obscuration; visibility 1 mile; light snow; temperature 28; dewpoint 24; wind calm, braking action poor; we have no outbound load."

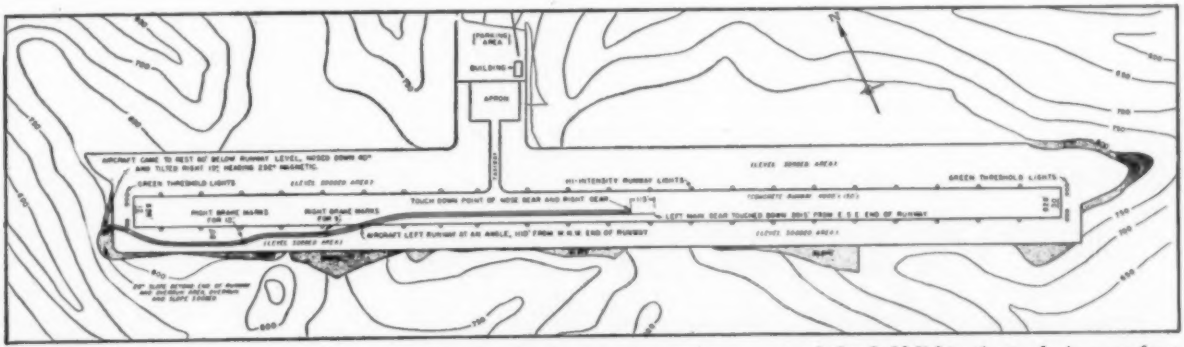
Charleston approach control then cleared the flight for an approach to the Huntington Airport, to descend to and cruise at 4,000 feet, and to report leaving 5,000 feet. The flight reported leaving 5,000 feet at 1837½ and passing the Wayne Intersection at 1838.

Flight 175 arrived over the Huntington H-facility[3] at 1842, and then, in accordance with prescribed procedure, flew outbound 17 degrees magnetic and made a procedure turn, descending to 700 feet above the ground before returning at 197 degrees magnetic over the H-facility. The aircraft then proceeded to and passed directly over the airport and its single runway at about a 90-degree angle.

Both pilots stated that all airport runway lights were sharp and clear through snow precipitation. A check of the windshield wiper and leading edge of the wing showed no ice. After crossing the airport the captain made a left turn of about 270 degrees, concluding the turn at an estimated three-fourths of a mile from the approach end of runway 30. Both pilots stated that again they could see all runway lights at that time.

Final approach was continued with landing gear down and flaps fully extended. The end of the runway was crossed at an estimated airspeed of 90-95 knots at an altitude of 50-100 feet. Just before touchdown Captain Moore advised Pilot Lane that he intended to use propeller reversing "because

[3] An "H-facility" is a nondirectional radio transmitter used for homing and navigational fixes.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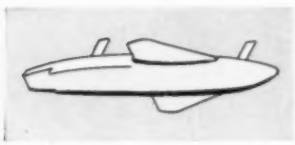
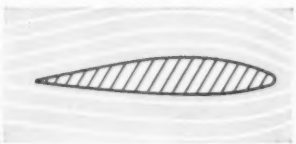
APRON
HI-INTENSITY RUNWAY LIGHTS
GREEN THRESHOLD LIGHTS
TOUCH DOWN POINT OF NOSE GEAR AND RIGHT GEAR
RIGHT BRAKE MARKS FOR 5'
RIGHT BRAKE MARKS FOR 10'
ILEVEL SODDED AREAS
ILEVEL SODDED AREA
CONCRETE RUNWAY 4600' x 150'
LEFT MAIN GEAR TOUCHED DOWN 200' FROM E.T.E. END OF RUNWAY
AIRCRAFT LEFT RUNWAY AT AN ANGLE, 100' FROM W.N.W. END OF RUNWAY
700
800
900

SKETCH OF TRI-STATE Airport at Huntington, W. Va., showing runway, terrain, runway and threshold lights, tire tracks in snow from touchdown to where plane came to rest, and brake marks.

Now even the ice- and snow-covered Arctic regions present no landing problems to aircraft whose design includes the Pantobase landing system. A product of Stroukoff research and development, Pantobase will permit landings and take-offs from snow, ice, sand, water and unimproved terrain, thereby extending the operational capabilities of the aircraft and reducing the need for conventional airports in many remote and previously inaccessible parts of the earth's surface.



Pantobase—When designed into an aircraft the Pantobase system enables the plane to land and take off from many types of surface without changes or additional landing equipment.



BLC-Boundary layer control as developed by Stroukoff increases the effective lift and delays stalling of the wing, thereby reducing required speeds and distances for take-offs and landings.

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SAFETY

of snow on the runway and possible poor braking."

Upon touchdown Pilot Lane raised the reverse thrust lockout flag, permitting propeller reversal before the aircraft's weight was on its landing gear, and the captain used reverse thrust beyond the normal reverse range into the emergency reverse range. Pilot Lane observed the No. 1 propeller reversing light come on slightly before No. 2 came on. According to the captain, No. 2 propeller lagged momentarily.

Forward visibility was completely cut off by surface snow blown forward and up by the reverse thrust. The captain noted a slight change in heading on the Flux Gate Compass and reduced r. p. m. in order to see where he was headed because of sharp dropoffs in the terrain near the runway edges, particularly to the left. When visibility was regained he realized that he was then going off the left edge of the runway. This was at a point about 1,400 feet beyond touchdown and about 1,100 feet short of the far end of the 4,600-foot runway. See diagram, p. 99.

Visibility Blocked

The captain then applied right rudder and right brake and increased the reverse thrust, taking more from No. 2 than from No. 1, bringing the aircraft to a course approximately paralleling the runway. Again blown snow blocked visibility and again the captain reduced power to regain it. He realized he was again turning to his left, away from the runway, and quickly applied right rudder and right brake to change direction. This accomplished its purpose until the aircraft was parallel to and approaching the end of the runway. Again the captain applied maximum reverse and lost all forward visibility.

During this relatively short period the aircraft maintained a course generally parallel to and at the left of the runway until, when nearing the end, it was turning to its left. It then went slowly over the brink some 100 feet beyond the runway. Both propellers remained in reverse thrust with varying amounts of power being used throughout the landing roll. Nose-wheel steering was not used to correct the swerves.

Just after the aircraft rolled over the brink of the slope the captain shut off all electrical power to lessen the possibility of fire. Total darkness resulted as the cabin emergency impact light did not come on. The stewardess was unable to reach it to turn it on because of the aircraft's extreme angle. She advised passengers to remain seated and calm.

Passengers Deplane

The aircraft came to rest on a ledge about 186 feet beyond, and about 60 feet below the level of the runway. The rough terrain sloped downward about 28 degrees; the aircraft was nose-down even more to 40 degrees and tilted 15 degrees to the right. Evacuation through the rear passenger loading ramp or via windows was not feasible because of their heights above the ground and the steep nose-down angle.

Consequently, and upon instruction from the crew using flashlights, all passengers deplaned via the left front loading door without disorder despite the difficulty induced and augmented by darkness and

slippery, rocky, sloping terrain.

The first point of touchdown was made by the left landing gear at a point 2,015 feet down the runway.

All three landing gears were on the runway a measured distance of 2,130 feet from the approach end and slightly left of center laterally.[1] This runway has no gradient and is 4,600 feet long and 150 feet wide, with level sodded areas extending about 100 feet at both ends. The left or south side is bordered with a level sodded area about 125 feet wide the other side has a similar area about 225 feet wide. The terrain falls away in varying degrees of steepness from both ends and from most of both sides.

There was no physical evidence of fire either before or after impact although several passengers reported a momentary flash fire near the left engine after the aircraft came to rest. Both propellers and the nose sections of both engines were torn free before the aircraft stopped.

The lower drag strut of the nose landing gear failed and the gear folded backwards damaging the adjacent lower portion of the fuselage. Damage to the fuselage, although of a major nature, was confined to the forward region generally below the aircraft's floor line. All passenger seats were intact and no seat belt failed. Emergency exit were not used but all were operational. Wing flaps were found fully extended.

Gears Locked

Examination of the landing gear latching mechanisms revealed that all three landing gears were extended and locked, and that the nose gear steering cylinder was intact and in normal operating conditions. Examination of the brake system failed to reveal any indications of operating distress and all hydraulic lines were intact. Both sets of main tires had about equal amounts of tread and inflation.

Both engines, both propellers, both propeller governors, and the two main landing gear wheels with their brakes were studied at the Miami base of Eastern Air Lines. This examination showed that:

a. Neither engine had had any evidence of failure or any precrash condition that would cause malfunctioning.

b. Both propellers had been operating within specified pitch limits and all examination of their components indicated that they were in good condition prior to impact with the ground.

c. Bench tests of both propeller governors revealed no evidence of failures or any condition that might have caused malfunctioning.

d. Both brake assemblies were in good condition and should have been operating normally. All brake pucks were free in their housings and show no excessive wear, nor did the brake housings show any evidence of excessive heat.

A careful examination showed that the rigging between the reverse throttle levers and the reversing throttle switches was such that final actuation of the reverse switches occurred when both throttles were moved aft 1½ inches. This specified rigging limit is 1½ inches, plus or minus ⅛ inch.

Examination of the rigging between the

[1] This, and other information, including the actual ground track of the aircraft down the runway, is depicted in diagram, p. 99.

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throttle levers in the cockpit and the throttle openings at both carburetors showed proper adjustment. With both throttles in the reverse idle position, both throttle arms were ¼ inch from their stops; with both throttles in the full reverse position, both throttle arms were 1¼ inches from their stops. Impact had stretched the throttle cables to a degree where testing of their tensions could not be significant.

All logbook entries for a significant period preceding the accident were carefully reviewed. Nothing was found to show evidence of operational difficulty or failure of the propeller reversing, hydraulic or breaking systems, or of the nose-wheel steering system. There were no squawks or mechanical irregularities reported by either of the two crews who flew N 487A on its two flights immediately prior to the one culminating in this accident.

Runway Lighting

The high-intensity runway boundary lights were of variable output and were set at position No. 3, which is midway in brilliance between positions No. 1 (minimum) and No. 5 (maximum). They had been at that setting before the accident and the incoming pilot did not request any change. His testimoney indicated that he was completely satisfied with the runway lighting and that runway lights were within his range of vision throughout the entire final approach.

The "poor" braking reported to the crew was the result of actually testing the braking conditions on the runway in an airport limousine equipped with snow tires only a few minutes before Flight 175 arrived.

Speed was increased up to 45-50 miles per hour with difficulty because of poor traction on the runway and the car then braked violently. The resulting skid and spin were of such nature that its driver, an airport employee, decided to use "poor" as a means of describing the condition, although there was some evidence that it was much worse than "poor." However, "poor" was entered in the official log, and was duly reported to and acknowledged by Flight 175.

The last previous flight to land at the Tri-State Airport before Flight 175 was also an EAL Martin 404. It landed without incident about one hour and 20 minutes earlier and its crew reported that braking was "fair." At that time snow was falling and the snow cover on the runway was about two inches deep.

Approach Normal

Eastern Air Lines' landing minimums for Martin 404's at Tri-State Airport are 700 feet ceiling and 1 mile visibility. Conditions prevailing at 1830, the last official observation, were reported to the incoming flight as 1,000 feet and 1 mile.

Captain Moore and Pilot Lane testified that their approach was substantially normal, that final was started at about three-fourths mile from the approach end of the runway at an estimated altitude of 500 feet, and that they came over the end of the runway at an estimated 50-100-foot altitude.

They also testified that their final turn into approach was terminated at the proper point so that little or no deviation from a straight path was necessary. However, this

is contrary to the testimony of a number of ground witnesses who described an appreciable bank to the right immediately prior to touchdown.

These witnesses in consensus, but with considerable generality, were of the opinion that the approach was higher and/or faster than is customary with similar aircraft. Captain Moore testified that he purposely came over the approach end of the subject runway a bit higher than at other airports because of the sharp drop in terrain at that end of the runway and the consequent possibility of turbulence at that point.

There was some testimony that a burst or several bursts of power were used just before touchdown, but the captain insisted that he did not apply any power at that time or elsewhere during final approach.

Reversal of the aircraft's propellers is accomplished by pulling back the main throttles to the idle position and then continuing rearward with the reversing throttle into the reversing range. For normal reversing the force required to pull the latter back is adjusted to eight pounds per throttle. An additional 15 pounds per throttle is required to bring them further back into the "emergency" reverse range. Thus the total force needed is 46 pounds.

Cockpit Warning

The Martin 404 aircraft carries a placard in the cockpit relative to reversing propellers.

It reads: "Exercise caution in using reverse thrust on runways covered with dust, snow, or other matter which would reduce visibility."

This same warning appears in Eastern Air Lines' Flight Manual for the Martin 404 which states further: "Caution should also be exercised when approaching the low speed range of the landing run so that the operator will be prepared for sudden control buffeting which might be injurious to the operator or structure unless the controls are monitored by the pilot or copilot during reverse thrust application. While the control forces are not excessive when operating in a normal power range for reverse thrust, the controls are subject to sudden and sharp reversals when approaching the slow speed range of the landing run."

All radio navigational and communication facilities, as well as the airport and runway lights, were found to have been operating normally.

Winds Light

Wind conditions at the Tri-State Airport were very light to calm at the surface when Flight 175 was making its approach and landing. The pressure gradient was weak in that area; light wind was indicated for the first two or three thousand feet above the surface. No turbulence was indicated at low levels.

The temperature on the morning of the accident had been down to 13 degrees and never rose above 32 degrees during the day. As thin obscuration of the sky existed, followed by an overcast, there was not much opportunity for the runway surface to have become warm enough to melt the snow even in the beginning of the fall. It therefore appears doubtful that ice existed below the snow cover unless it remained from a previous condition. However, in some cases

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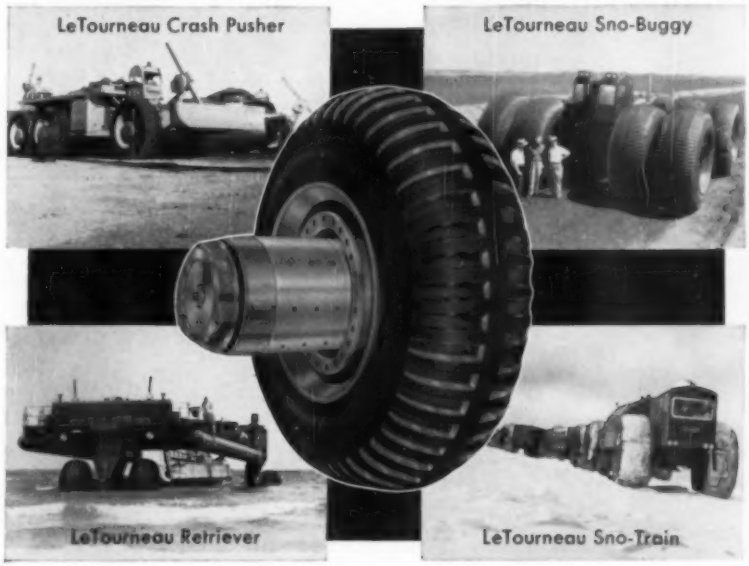

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very poor braking exists on a dry snow cover.

The weather reporting service at the Tri-State Airport at Huntington, West Virginia, is classed as a Supplemental Aviation Weather Reporting Station. This means that the observers have been obtained by the Weather Bureau from airline and/or airport personnel and that following a period of training in weather observations, they have been certificated as competent to make surface weather observations.

ANALYSIS

Captain Moore attributed the first swerve to the left to a momentary lag in the No. 2 (right) engine. This would cause more, or quicker, reverse thrust on the left engine than on the right and consequently result in a tendency to yaw to the left. But it seems unlikely that any momentary lag in the No. 2 engine caused the initial swerve because the aircraft traveled a good 1,000 feet before swerving. (This distance would have taken 7.4 seconds at an assumed average speed of 80 knots.)

Subsequent swerves to the left, as the aircraft continued generally parallel to the runway, occurred as Captain Moore attempted to use maximum reverse thrust to stop the aircraft on the airport. He was using different amounts of reversing to effect steering and stop the aircraft without any forward visibility except for two brief periods, as described.

The given braking condition of "poor" did not carry with it a warning against landing; it was merely information for the captain to use as he saw fit. Adjectives in common usage to describe braking effectiveness are "good," "fair," "poor," and "nil." None, not even "nil," is tantamount to a prohibition against landing because even with little or no braking it is possible to land and stop on certain runway lengths, depending on wind, gradient, altitude, temperature, and other factors.

Final Approach

Captain Moore could not explain why he landed so far down the runway after a final approach such as he described. As stated, there was little or no wind, and if the aircraft had crossed the boundary at 50 feet altitude and at the conventional speed of 90-95 knots, then the touchdown should have been well within the first quarter of the runway.

If the approach was conducted as Captain Moore testified, then there would have been no need for any final maneuver or maneuvers just prior to touchdown as described by witnesses, although denied by Captain Moore. It seems probable that there was some misalignment of the final approach to the right of the runway as a result of overturning during the close-in circling approach.

The fact that Captain Moore advised Pilot Lane to raise the reverse flag before touchdown indicates that he realized he was then critically far down the runway and wanted to be sure of instantaneous reversal on demand.

The Board concludes that Captain Moore made his last turn into final somewhat higher, closer, or faster than he would have during better visibility. Visibility of one

mile was exactly at authorized minimum.

It was found during the course of the investigation that additional training of the weather observers would be desirable. This does not appear to have been a factor in the accident; however, the Weather Bureau has started a program for improving the training of personnel and inspection of this class of stations.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft, and the crew were properly certificated.
2. The last weather report for 1830 given the flight included 1,000 feet ceiling, 1 mile visibility, and light snow; the captain confirmed that these conditions prevailed during the approach.
3. Captain Moore had been advised of snow on the runway and that braking conditions were poor.
4. The approach caused the touchdown to be nearly half-way down the 4,600-foot runway.
5. Captain Moore was familiar with the aircraft's placard warning of the use of propeller reversing on ground snow and the elaborated material on the subject contained in the aircraft's flight manual.
6. Propeller reversal blew up snow, completely obscuring forward visibility.
7. The on and off application of reverse thrust, in order to regain visibility, impaired deceleration so that the aircraft overran the airport.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was improper approach and subsequent landing too far down a snow-covered, slippery runway.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Chan Gurney
/s/ Harmar D. Denny

Joseph P. Adams, Vice Chairman, did not participate in the adoption of this report.

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident shortly after occurrence. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

Depositions in connection with the investigation were taken at Huntington, West Virginia, on February 13 and 14; at Chicago, Illinois, on February 15; at McGuire Air Force Base, Trenton, New Jersey, on March 8; and at Washington, D. C., on May 15, 1956.

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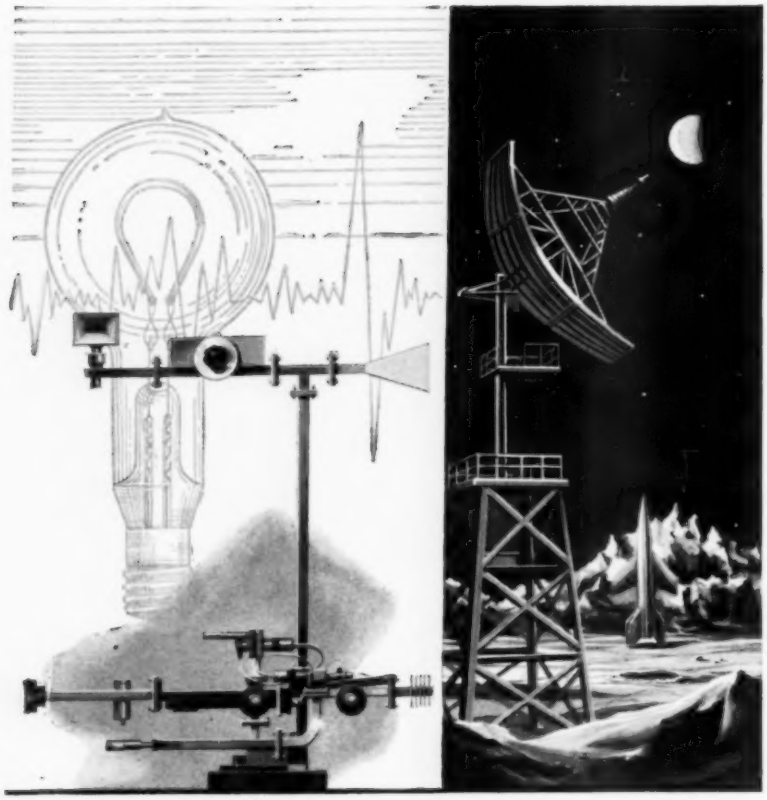

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Captain Robert C. Moore, age 34, was employed by Eastern Air Lines as a pilot on June 6, 1946, and made his first flight as captain on July 1, 1953. He held a valid airline transport pilot certificate with a rating for the subject aircraft. Captain Moore had a total of 9,680 flying hours, of which 2,351 hours were in Martin 404's, and 535 hours of instrument flying. He passed a CAA physical on October 27, 1955. Captain Moore had made 11 previous landings at Tri-State Airport, all at night and all in Martin 404's.

Pilot James L. Lane, age 29, was first employed by Eastern Air Lines, Dec. 28, 1953. He later was furloughed, was re-employed on Aug. 8, 1954, again furloughed, and again re-employed on Dec., 1955. He held a valid commercial pilot certificate with airplane single- and multi-engine land and instrument ratings. Pilot Lane had a total of 2,426 flying hours, of which 856:17 hours were in Martin 404's, and 90:29 hours of instrument flying. He passed a CAA physical on December 15, 1955.

Flight Attendant Dolores D. Pauls, age 23, was employed by Eastern Air Lines as a student flight attendant on June 6, 1955. She completed Eastern Air Lines Flight Attendant Training on July 9, 1955, and was then promoted to flight attendant.

The Aircraft

N 457A, a Martin 404, serial number 14235, was owned and operated by Eastern Air Lines and was currently certificated by the Civil Aeronautics Administration. The aircraft had accumulated approximately 9,854:00 hours. It was equipped with two Pratt and Whitney R-2800-CB3 engines and two Hamilton Standard model 43E60 propellers. The airframe, engines, and propellers had been maintained in full compliance with prescribed methods and within all time limitations.

CAB Working With Venezuelans in Crash

Washington—The Civil Aeronautics Board will work with the Venezuelan government in its investigation of the June 20 crash of a Linea Aeropostal Venezolana transport off the New Jersey coast last month.

The LAV Super Constellation was returning to Idlewild Airport with engine trouble when it caught fire while dumping gas. It crashed at sea killing all 74 occupants.

Venezuela has accepted a U.S. offer to help with the accident investigation, and the CAB has assigned Gordon Mathews, assistant chief, Investigation Division of the CAB Bureau of Safety Investigation, and C. E. Searle of the CAB's New York office to cooperate with Venezuelan officials.

The Venezuelan government has sent Capt. Gesus Idriago and Miguel Grunstein, heads of the Division of Air Security, Civil Aeronautics Administration, Ministry of Communications, to conduct the investigation.

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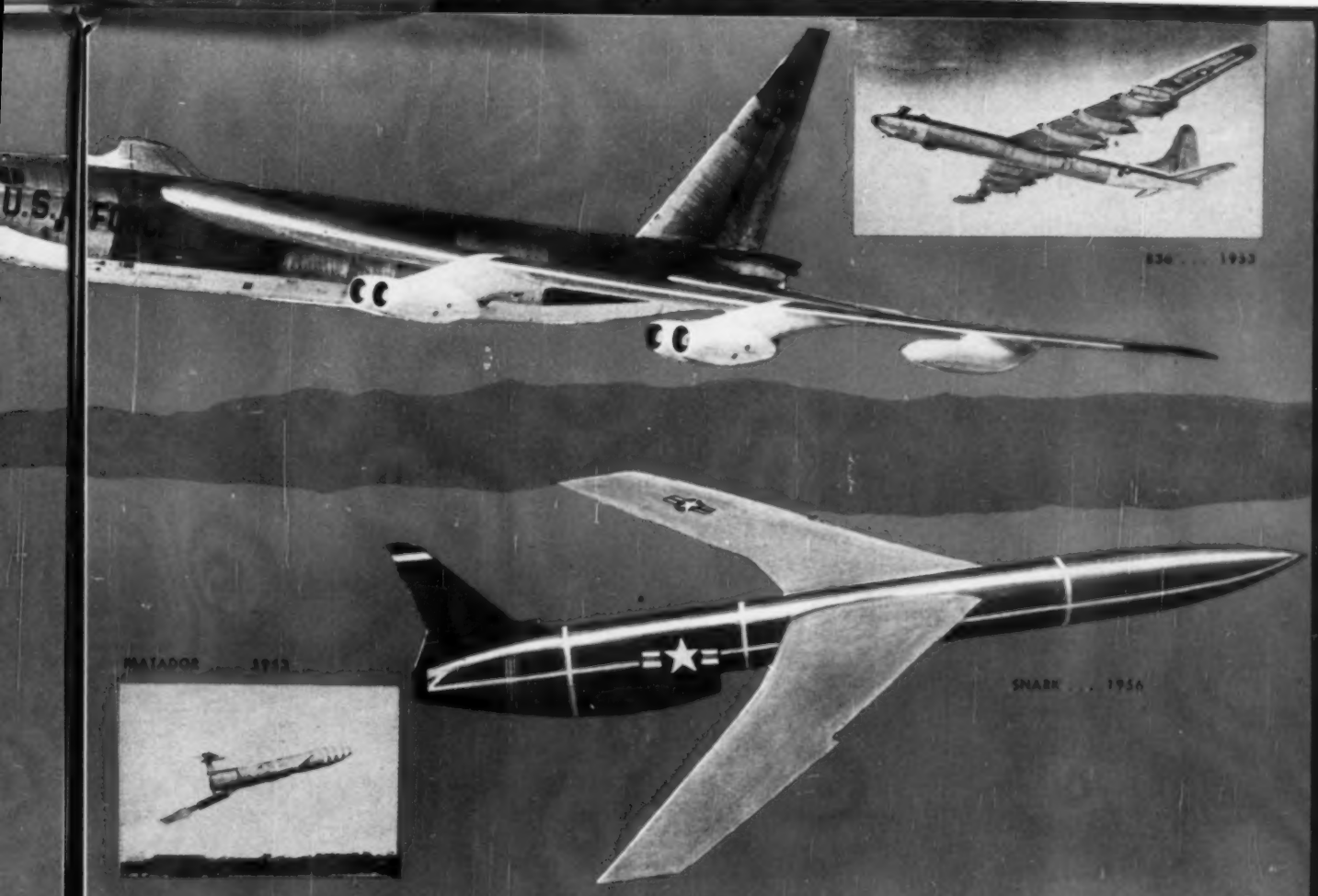

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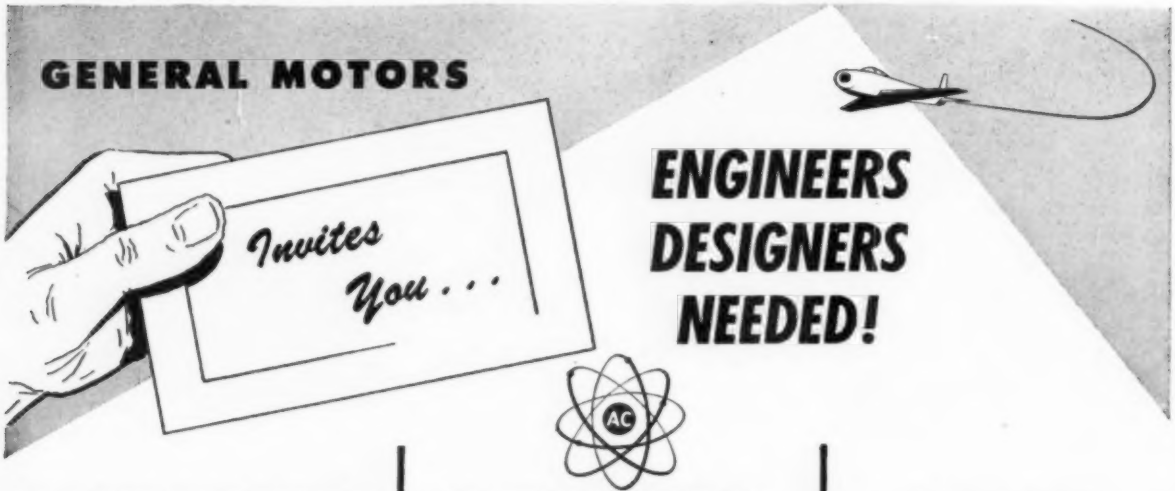

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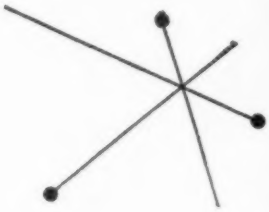
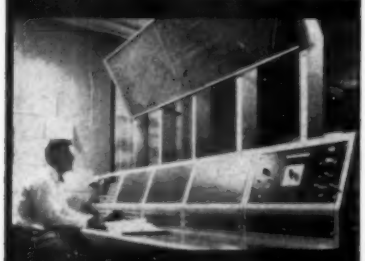


ERMA

electronic recording machine accounting



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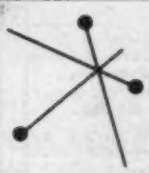

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Milwaukee 2, Wis.

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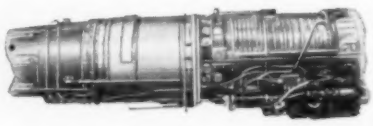

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LETTERS

Last Fastener Word?

The undersigned makes reference to the letter of J. Mills Summers, president of Camloc Fastener Corp., appearing on page 154 of your May 14 edition entitled "Fastener Status."

It is not the intent of the Pachmayr Corporation to enter into a series of letters or counter letters, but (the company) desires to close the issue with this communication insofar as public print is concerned by quoting from the Dec. 30, 1955, letter from Headquarters, Air Materiel Command, Supply Division:

"The decision to standardize on this particular fastener is the result of several years study, laboratory tests, and service tests by Air Materiel Command, Strategic Air Command, Wright Air Development Center, and the Bureau of Aeronautics. The fastener was designed and patented by an employee of Air Materiel Command in 1944. Several years ago the Pachmayr Corporation became interested in the fastener and made many improvements and refinements over the original product. The Pachmayr Corporation has granted the Government non-exclusive, royalty-free license to manufacture, or cause to be manufactured, for military purposes, the fastener, and further, has granted the Government the right to reproduce any and all their data and drawings for the purpose of standardization.

"The adoption by the Air Force will result in the reduction of stocked parts from 1049 to 78. Lower maintenance cost will result, because of its universal nature, one fastener assembly in a particular size and type can satisfy normal installations presently requiring 25 assemblies. The stud, which uses a high lead interrupted thread, permits engagement with the mating receptacle at any point through a grip range of .250 inches.

"A complete set of Military Drawings and supporting specifications are now being prepared by the Air Research and Development Command. These documents will enable the Air Force to procure this fastener on open competitive bids. The name, Pachmayr Universal Fastener, will be changed to Turnlock fastener."

Since 1944 the air forces have been interested in the universal characteristics of this fastener. The Pachmayr Corporation in realizing the government's interest in continually seeking for improvements in its military products investigated the inherent qualities and possibilities of this Turnlock fastener. In early 1950 the Pachmayr Corporation started an extensive program of research and development to improve the Turnlock fastener to its present level. During this six and one-fourth years many improvements in the product were made. Also, the methods and techniques necessary to produce the Turnlock in high quality, high production quantities have been overcome.

Having expended on its own toward this program approximately $500,000, the Pachmayr Corporation does have the ability to produce the Turnlock fastener in sufficient quantity to meet the demands of the general standardization program at competitive prices.

As indicated by the quotations above, the Government has the license to manufacture or cause to be manufactured for military purposes the Turnlock fastener. To our knowledge no production contract has been let by the Government to any manufacturer for this fastener.

FRANK PACHMAYR, President
Pachmayr Corporation
2222 South Figueroa
Los Angeles 7, California

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Unrewarded Engineers

I should like to add my comments to the many I am sure you are, and will be, receiving on your editorials on the engineering shortage, and on one letter which you published recently (AW June 4, p. 122).

Mr. D. J. Abel comments on the danger of the possible use of more non-graduate engineers "lower(ing) the status of the professional engineer by allowing non-professionals to enter the field." Apparently Mr. Abel thinks that a degree makes a man a professional engineer. It is this sort of snobbery, and this self-delusion about engineering being a true "profession" which in itself has degraded the entire engineering field to its present unrespected and unrewarding status. This illusion, fed and fostered by many an employer, has made many a man think of the honor and glory of his "profession" rather than his true position, to the general destruction of the position of all engineers, graduate and non-graduate, in this country.

Regarding your editorials, I beg you, please do not fail in your courage and allow this excellent series to degenerate into a repetition of the many inane articles written on the subject in the past few years. Above all, please research and disclose the facts about salaries, advancements and ultimates in the various engineering fields today. My own findings have been:

(1) The shortage consists of a need for:
   a. Men of no or little experience to do the dog-work.
   b. Some specialists of large experience who are very rare.
(2) Men of considerable experience and broad background and needed, but no one seems willing to pay for them.
(3) The salary barrier lies between $9,000 and $10,000, administrative experience is required to reach the barrier.
(4) The opportunities beyond this barrier are few and far between, using the personnel department route. Personal contacts may yield better results.

During a recent four-month campaign to obtain a new job, which was finally successful, some other points became quite obvious to me. These include:

(1) There is a real engineering shortage.
(2) Vast "opportunities exist at salaries from $5,000 to $9,000.
(3) Despite ads and claims, few high level posts are really available, at least through conventional channels.
(4) Sad as it seems, the engineering field is one of contracting rather than expanding opportunity. Some of the reasons for this are:
   a. Emphasis on advanced degrees for high technical positions. It is my opinion this is irrational in most cases.
   b. The lack of realization on the part of many managements that engineering administration may be best accomplished by engineers of broad and developed capabilities.
   c. The invasion of the upper echelon of engineering by the scientist. The scientist has a real solid place, but it is not in engineering, per se, as so many seem to think.
   d. The invasion of the upper echelon of engineering by non-technical people who are in fashion at the moment, for example, business administration graduates. Time was former sales people were in fashion for similar posts.
   e. An inability on the part of many managements to conceive of the true role of engineering in today's technical industries. The high **technical** level engineer has always and will continue to perform functions of decision and commitment involving a firm's finances and reputation which no other person, regardless of his position, is equipped to perform. Why engineers as a group have allowed themselves to be placed in their present position of low respect, low esteem and poor potential, in view of this consideration, is beyond all comprehension. The results, however, all engineers know—poor salaries, large responsibilities, little recognition, indignities which no masagement-type person would endure (how many engineering departments still have time clocks?), and a future which quickly reaches a stone wall.

What effects do these factors have on the engineering shortage? College freshmen, particularly the engineering types, are not fools. They soon learn, from friends and inquiry, that the comparatively easy four years in business administration will pay off better than four to seven years of grinding to become an engineer. The man who does go into the field, either through the ordeal of college, or the greater ordeal of the non-graduate, soon sees the handwriting on the wall. Many see it early enough to get out of the field and into sales or administration while they can. Thus we have fewer people entering the field, and fewer remaining in it, despite the grandiose advertising of the glowing future in engineering today.

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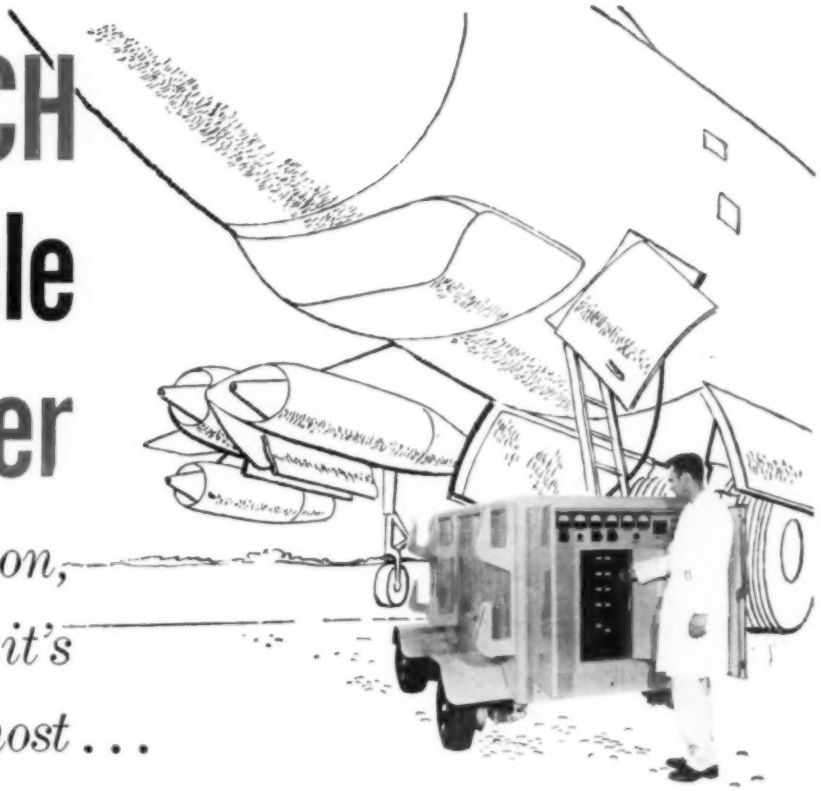

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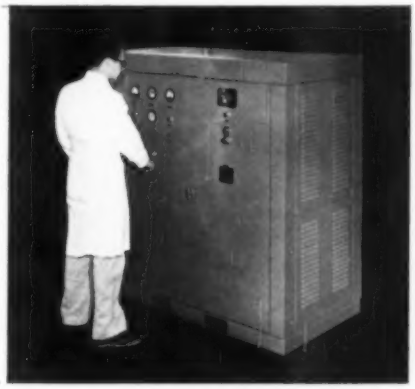

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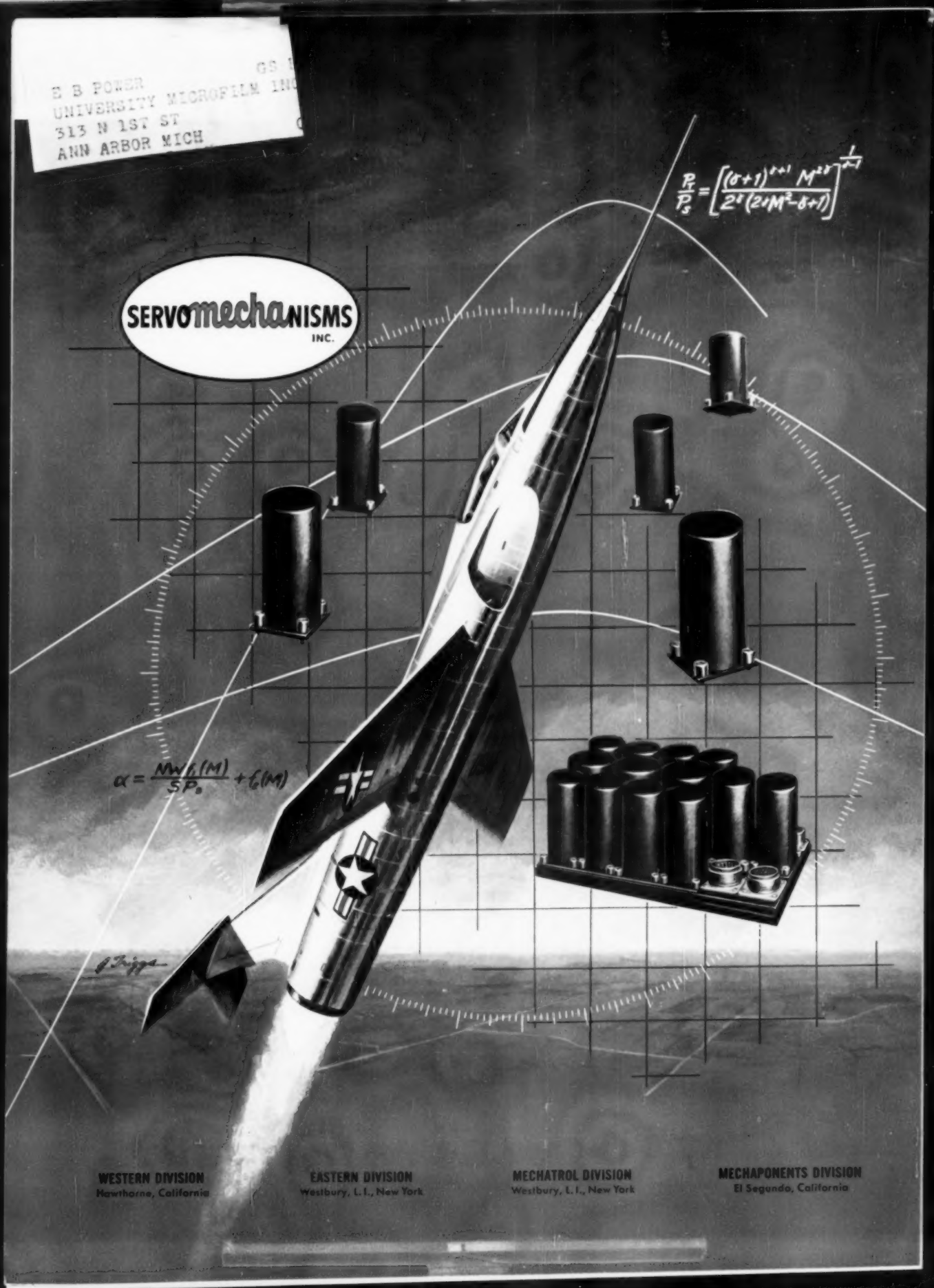
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